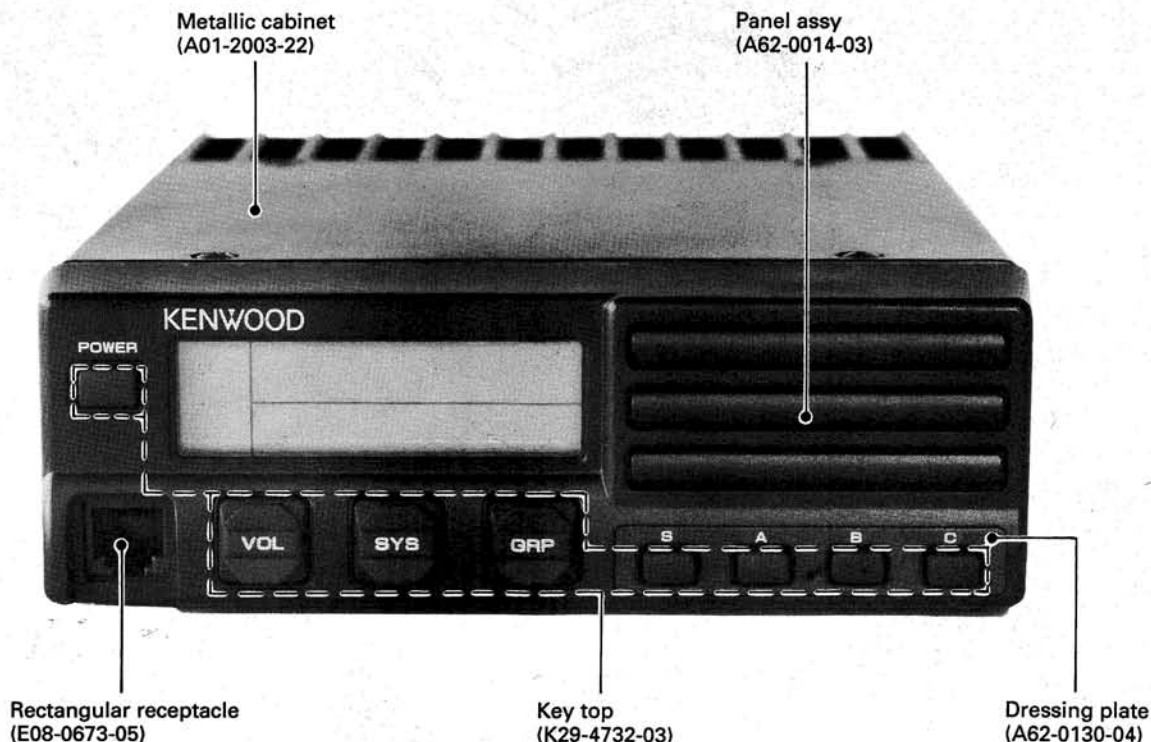


TK-931A(D)/931A(HD)

SERVICE MANUAL

KENWOOD

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TK-931A(D)/931A(HD)

SPECIFICATIONS

GENERAL

Frequency Range	RX : 935~941MHz TX : 896~902MHz, 935~941MHz
Systems/Channels	6 systems/120 channels : TK-931A(D), 10 systems/200 channels : TK-931A(HD)
Groups	4 groups per system : TK-931A(D), 10 groups per system : TK-931A(HD)
Conventional Channels	4 channels per system : TK-931A(D), 10 channels per system : TK-931A(HD)
Channel Spacing	12.5kHz
Input Voltage	13.6V DC negative ground
Current Drain	0.4A on standby 1.0A on receive 5.0A on transmit : TK-931A(D), 9.0A on transmit : TK-931A(HD)
Duty Cycle	Receiver 100%, Transmitter 20%
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Dimensions and Weight	5.91" (150mm) W x 1.97" (50mm) H x 7.48" (190mm) D, 3.09 lbs (1.4kg) : TK-930A(D) 5.91" (150mm) W x 1.97" (50mm) H x 8.66" (220mm) D, 3.53 lbs (1.6kg) : TK-930A(HD)

RECEIVER (Measurements made per EIA standard EIA-204-C)

RF Input Impedance	50Ω
Sensitivity (EIA 12dB SINAD)	0.35μV
Modulation Acceptance	±3.5kHz
Selectivity	-70dB
Intermodulation	-65dB
Spurious and Image Rejection	-75dB
Frequency Stability	±0.00015% from -30°C to +60°C
Channel Frequency Spread	6MHz
Audio Power Output	4W at less than 5% distortion

TRANSMITTER (Measurements made per EIA standard EIA-152-B)

RF Power Output	15W adjustable to 5W : TK-931A(D) 30W adjustable to 15W (More than 20W for talk-around) : TK-931A(HD)
RF Output Impedance	50Ω
Spurious and Harmonics	-65dB
Modulation	F3E, F1D, F2D
FM Noise	-40dB
Microphone Impedance	Low impedance
Audio Distortion	Less than 3% at 1000Hz
Frequency Stability	±0.00015% from -30°C to +60°C
Channel Frequency Spread	45MHz

APPLICABLE MIL STANDARD

MIL 810C Methods/Procedures	Rain : 506.1/2	Shock : 516.2/1,2,3,5	Vibration : 514.2/8
MIL 810D Methods/Procedures	Rain : 506.2/2	Shock : 516.3/1,4,5,6	Vibration : 514.3/1

APPLICABLE ENVIRONMENTAL EIA STANDARDS

EIA 152C, 204C Shock, Vibration, Humidity

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OPERATION FEATURES

3-28. AmeriCom dispatch

If a unique mobile ID is set in the pre-stored number, a mobile-to-mobile private call can be placed. This call is placed in the same way as for placing an AmeriCom telephone call. See Sections 3-26 and 3-27.

If the radio does not have pre-stored numbers corresponding to the system and group, the procedure for the dispatch call is the same as that for the LTR ID dispatch call.

3-29. Automatic roaming

If the roaming function is enabled and the radio is out of range of the preferred system, the radio searches for programmed AmeriCom systems unless the roam lockout is programmed. The display shows that the radio is roaming. The message "ROAMING" appears on the alphanumeric display. A dash (-) appears on the system and group displays.

If the radio finds a system, it tries to check it in. The message "CHECKIN" appears on the alphanumeric display. If the check-in succeeds, the radio display shows the preferred system and group. The Roam (Ⓢ) indicator lights to show that the radio is roaming.

Pressing the PTT switch accesses the preferred system's group setting using the roamed system. Changing the group switch changes the preferred system's group setting.

Only pre-stored numbers are available to transmit. If an LTR ID was programmed on a preferred system's group setting, the radio sounds the intercept tone.

3-30. Roaming display

When the radio is roaming, the Roam (Ⓢ) indicator lights to show it. The system and group displays show the preferred system and group. When the S (Select) button is pressed momentarily, the radio system display shows the roaming system, and the group display shows a dash (-). The cell ID number appears on the alphanumeric display. This is useful to confirm the system being used.

If the S (Select) switch is held down for two seconds or more, the Roam (Ⓢ) indicator goes off, and the radio changes from the preferred system to the system roamed to. The group display indicates the revert group of that system. The cell ID number of the system appears on the alphanumeric display only when the S (Select) button is held down while the Roam (Ⓢ) indicator is off. Thus, you can confirm the cell ID number of the system being used.

3-31. Roam lock out

If the roaming feature is programmed as "NO" by the system flag setting, the system is not searched for during roaming.

If the radio goes out of range after this system is selected, the system remains valid.

If this system is selected, the ► mark on the system display lights.

If the radio cannot check into this system, the message "NO SERVC" appears on the alphanumeric display.

3-32. Test mode

The TK-931A(D) and TK-931A(HD) transceivers have a test mode.

To enter the test mode, set button SW100 on the TX-RX unit to the TEST position. When the power is buttoned on with the button set to this position, the test mode is entered. To exit the test mode, reset the button to the NORMAL position, and turn the power off and then back on again. The mode will not be changed merely by resetting the switch. The following functions are available in the test mode.

• SYSTEM button

The SYSTEM button is used to select up to ten pre-programmed test frequencies.

• GROUP button

The following modulation signals can be selected.

Group	Modulation
1	No modulation
2	LTR format data
3	ACLS format data
4	ACHS format data
5	100Hz square wave

• A button

When the A button is pressed in the test mode, the transmitter enters the talk-around mode to transmit with the receive frequency, and the Auxiliary indicator lights.

• B button

In test mode, the receiver operates with carrier squelch. When the B button is pressed, the data decode function set in groups 2 and 4 is added.

• C button

If the C button is pressed in the test mode, carrier squelch is turned off. If there is no signal noise is output by the speaker and the BUSY indicator lights.

OPERATION FEATURES

- **S button**

When the S button is pressed in the test mode, scanning occurs. A dash (–) appears on the system and group displays, and all programmed test frequencies are scanned.

- **Alphanumeric display**

The alphanumeric display shows the frequency on which the radio operates in test mode.

- **Transmitter**

The transmitter is keyed using the microphone PTT button.

The modulation signal selected with the GROUP button is transmitted.

4. Transceiver Programming

4-1. Preface

When a TK-931A(D) or TK-931A(HD) transceiver is used in the AmeriCom network, it can be programmed by OAP on the Network Manager. If only an LTR system is used, the service time and OAP frequency are programmed using a personal computer, programming interface (KPG-4), and programming software (KPG-12D).

The programming software can be used with an IBM PC or compatible. Figure 2 shows the setup of an IBM PC for programming.

4-2. KPG-4 description

(P.C. programming interface cable : option)

The KPG-4 is required to interface the TK-931A(D) and TK-931A(HD) to the computer. It has a circuit in its D-subconnector (25-pin) case that converts the RS-232C logic level to the TTL level. The KPG-4 connects the front panel modular microphone connector of the TK-931A(D) and TK-931A(HD) to the computers RS-232C serial port.

4-3. Programming software description

The KPG-12D is the programming software for the TK-931A(D) and TK-931A(HD) supplied on a 5.25" floppy disk and a 3.5" floppy disk. This software runs under MS-DOS (version 3.1 or later) on an IBM-PC/XT, AT, or PS2, or compatible. Data can be input to or read from the TK-931A(D) and TK-931A(HD) and edited on the screen, and programmed data can be printed.

4-4. Program mode

Data can be programmed into the EEPROM via the microphone connector. To set the transceiver in this mode, hold down the A (Auxiliary) switch, switch the power on, wait for at least 3 seconds, then release the A switch.

The system and group display show a dash (–) and indicates "PROGRAM" on the alphanumeric display.

In this mode, the microphone PTT and Hook lines operate as TXD and RXD data lines respectively.

If the program ends normally, the message "END" appears on the alphanumeric display. If an error occurs, the message "ERROR" is displayed. This mode is terminated by switching the power off.

4-5. RCCB number

The TK-931A(D) and TK-931A(HD) have been programmed at the factory to have different RCCB numbers. When the transceiver is set to the Program mode, and the Group DOWN button is pressed, an eight-digit hexadecimal RCCB number appears on the alphanumeric display for confirmation. The RCCB numbers of the TK-931A(D) and TK-931A(HD) are in the range 135,266,304 (08100000 hex) to 136,314,879 (081FFFFF hex). This mode is terminated by switching the power off.

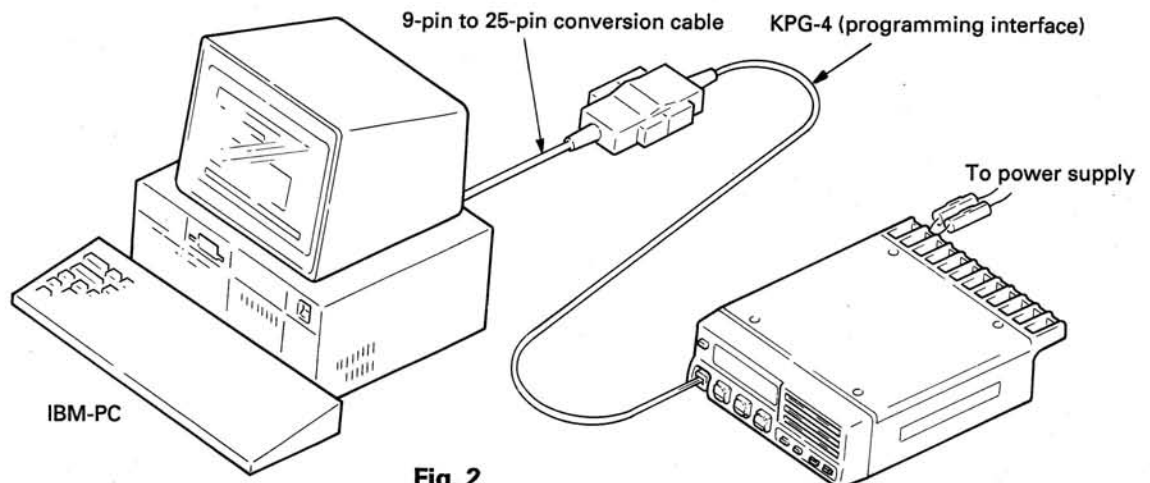


Fig. 2

TK-931A(D)/931A(HD)

OPERATION FEATURES

4-6. Minimum volume level

The TK-931A(D) and TK-931A(HD) have an automatic volume setting feature, but the maximum volume level when the power is switched on can be modified. To set this mode, set the transceiver to Program mode, and press the Volume Up/Down button. The message "VOL SET" appears on the alphanumeric display, and the preset number of steps (0~31) appears on the system and group displays. (The system display shows the high-order digit, and the group display shows the low-order digit.)

The low-order digit can be changed with the Group Up/Down button, and the high-order digit can be changed with the System Up/Down button. When the Volume Up/Down button is pressed, a busy tone sounds to confirm the volume level. The default value is step 6. This mode is terminated by switching the power off.

4-7. OAP frequency programming

The OAP frequency can be programmed by the transceiver itself. When the transceiver is set to program mode, and the system button is changed, the OAP frequency appears on the alphanumeric display. The digit that can be modified flashes. It can be changed by pressing the System Up/Down button. The digit that can be modified is changed by pressing the S (Select) button. The FCC channel number can be also set by pressing the A button. This mode is terminated by switching the power off. If the power is switched on again (without pressing the A button), OAP can start.

TK-931A(D)/931A(HD)

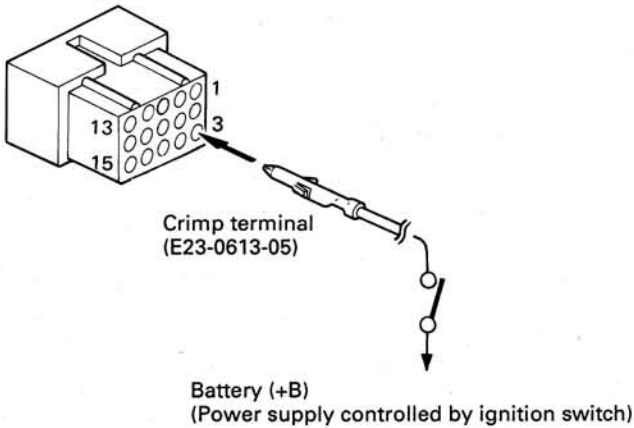
MODIFICATION

Modification to Turn the Power On and Off or Control the Horn (When the Horn Alert is Used) Using the Ignition Sense

1. Modification method when horn honk is inhibited by ignition sense (IGS)

Connect the power supply (+B) controlled by the ignition switch to pin 3 of short plug J5 which is inserted into connector J4 on the rear of the radio.

Shot plug J5



• Modification method when the radio power is turned on and off by ignition sense

Remove R131 (0 Ω) from the TX-RX unit, and add R130 (220k Ω). (R131 is installed at the factory.)

In this case, horn honk is always inhibited. To enable horn alert when the power is switched on, remove R125 (47k Ω) of the TX-RX unit.

2. Modification method when horn honk is enabled when the microphone is off-hook

Remove R129 (22k Ω) of the TX-RX unit. (R129 is installed at the factory.)

Horn honk is usually disabled when the microphone is off-hook.

TX-RX unit (Foil side view)

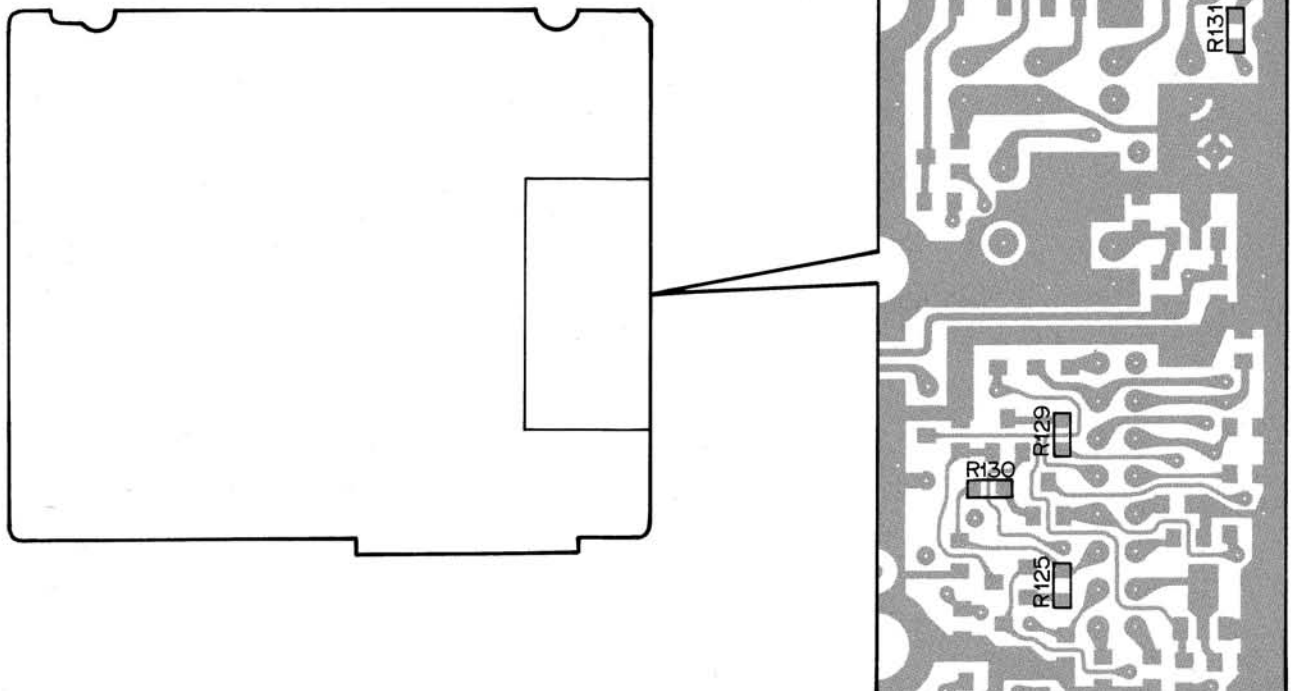


Fig. 1

DISASSEMBLY FOR REPAIR

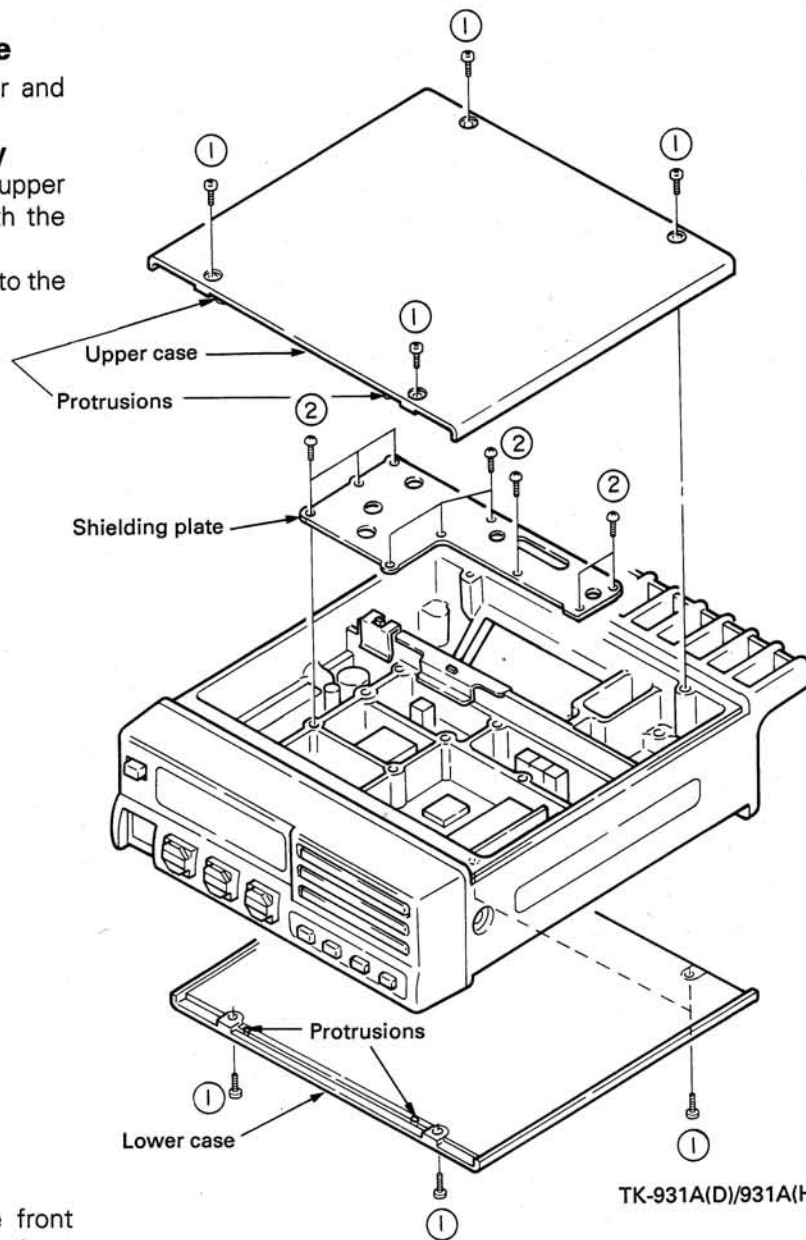
1. Removing the Case and Shield Plate

1. Remove the eight screws holding the upper and lower cases, then remove the cases (❶).

Caution on TK-931A(D)/931A(HD) assembly

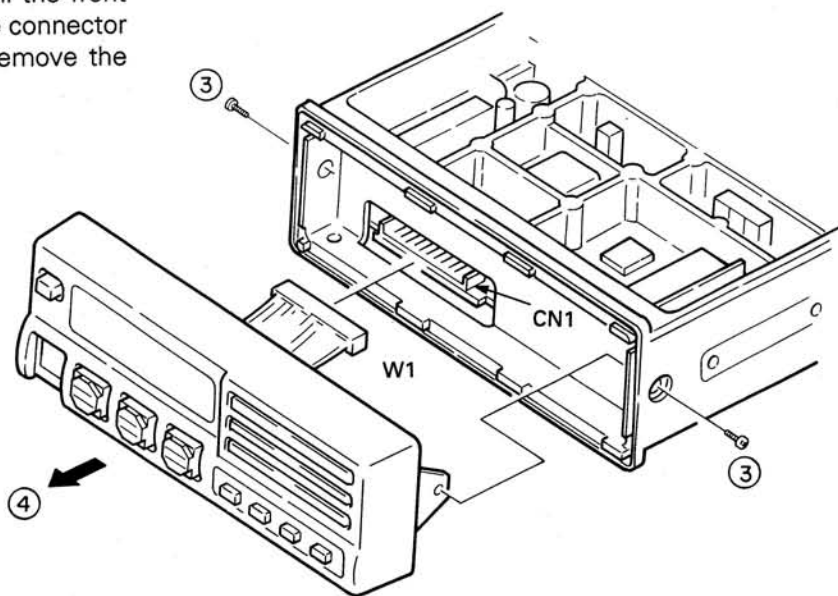
There are protrusions on the side of both the upper and lower halves of the case. Assemble with the protrusions on the front panel side.

2. Remove the 9 screws holding the shield plate to the frame, then remove the shield plate (❷).



2. Removing the Front Panel

1. Remove the two screws (❸) holding the front panel to the sides of the frame, and pull the front panel (❹) forward slightly. Remove the connector cable (W1) from the TX-RX unit, then remove the front panel (❹).

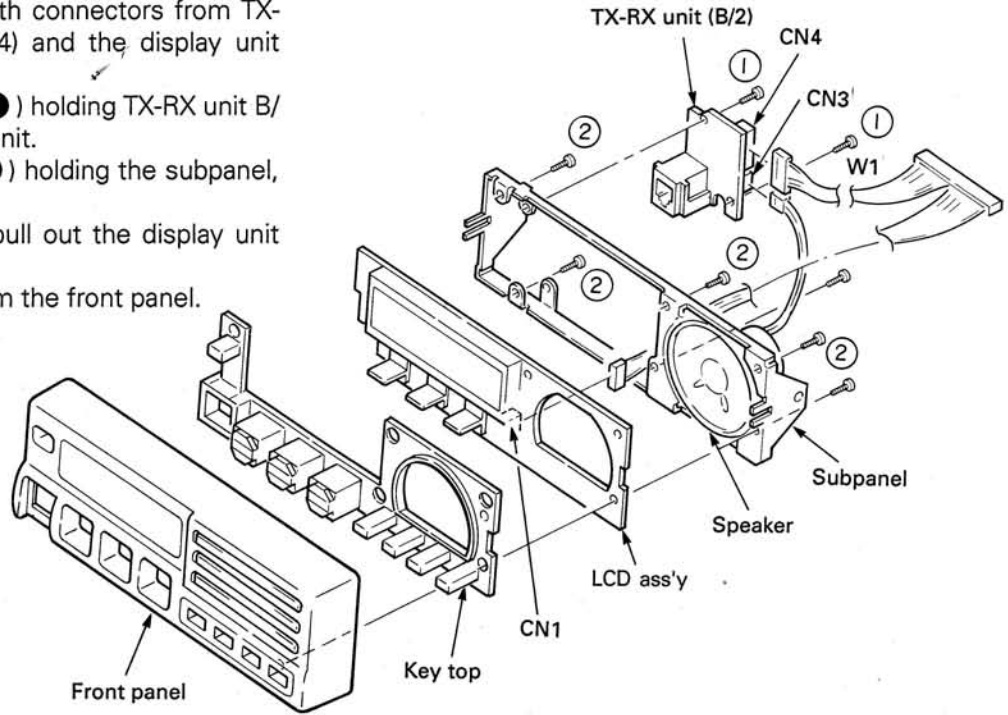


TK-931A(D)/931A(HD)

DISASSEMBLY FOR REPAIR

3. Disassembling the Front Panel

1. Remove the cable (W1) with connectors from TX-RX unit B/2 (CN3 and CN4) and the display unit (CN1).
2. Remove the two screws (1) holding TX-RX unit B/2, then remove the TX-RX unit.
3. Remove the six screws (2) holding the subpanel, then remove the subpanel.
4. Remove the speaker and pull out the display unit from the front panel.
5. Pull out the bottom tops from the front panel.



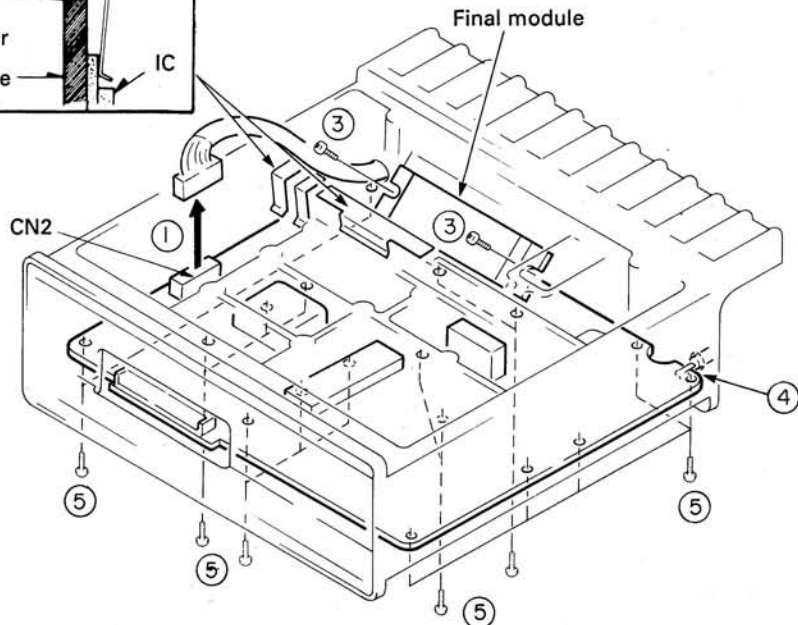
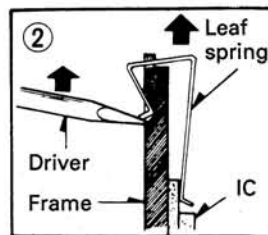
4. Removing the TX-RX Unit

1. Remove the cable connector (1) from CN2.
2. Remove the two leaf springs (2) holding the IC by pushing them up with a screwdriver.
3. Remove the two screws (3) holding the final module.

Note : To replace the final module, remove the lead soldered to the TX-RX unit.

4. Remove the metal plate (4) to which the N type socket (J2) and TX-RX unit have been soldered.
5. Remove the 16 screws (5) holding the TX-RX unit, then remove the TX-RX unit.

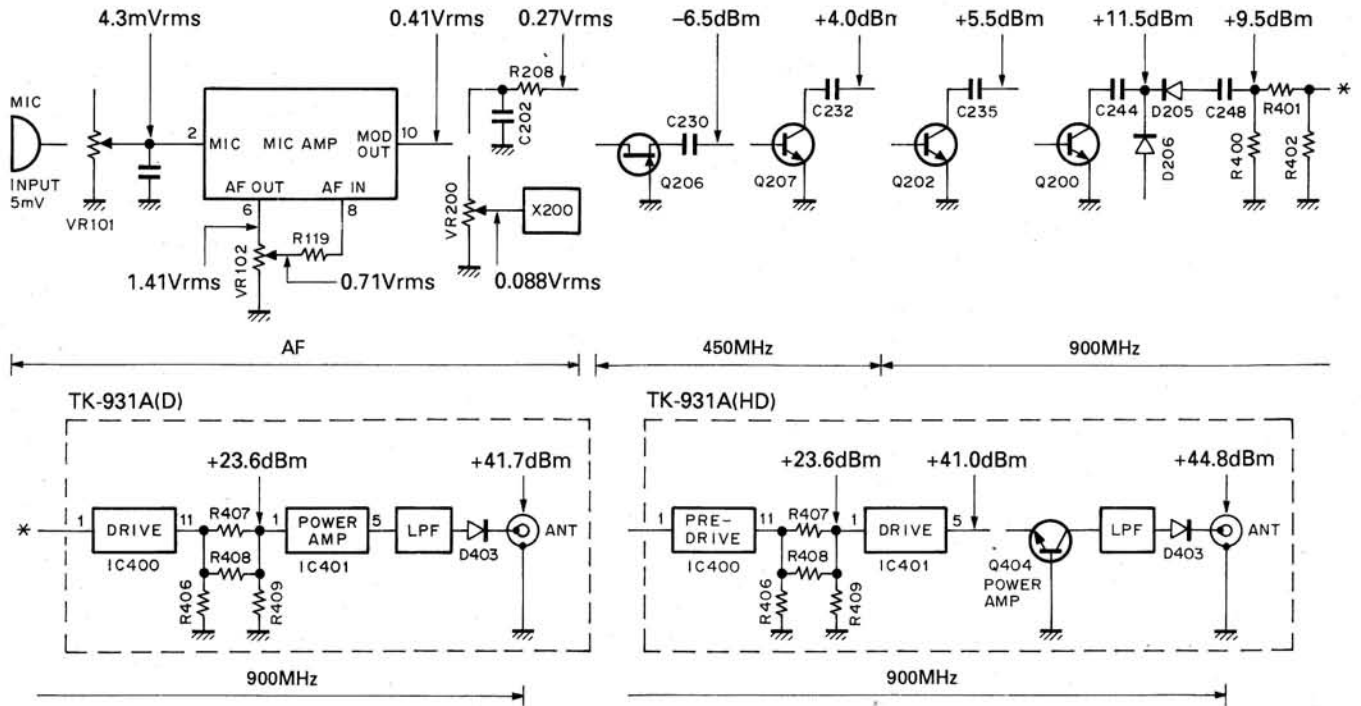
Notes : For the high power model, remove the two screws holding the final transistor. To remove the TX-RX unit completely, desolder the two leads from the power connector.



TK-931A(D)/931A(HD)

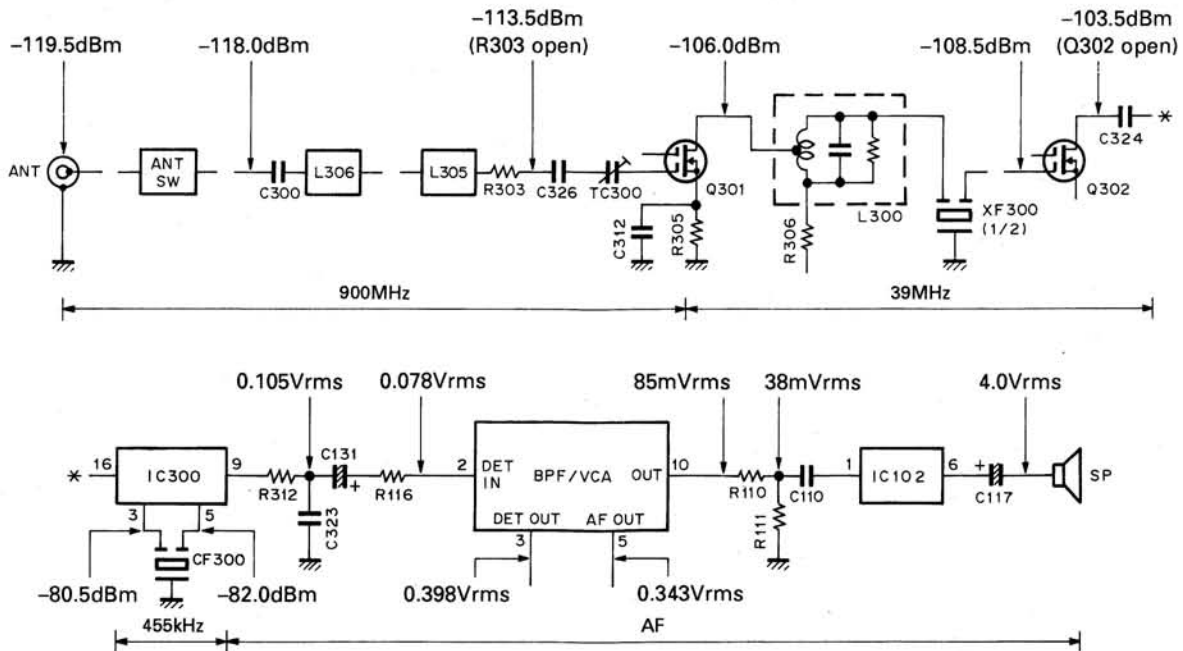
LEVEL DIAGRAM

TX Section



To make measurements in the AF section, connect the oscilloscope probes directly. In the RF section, use a 1000pF coupling capacitor.

RX Section



To make measurements in the AF section, connect the oscilloscope probes directly. (ANT input : -47dBm, 1kHz FM, 1.5kHz dev.) In the RF section, use a 1000pF coupling capacitor. (The display shows the SSG input value required to obtain 12dB SINAD.)

TK-931A(D)/931A(HD)

CIRCUIT DESCRIPTION

1. Overview

This transceiver is an 900MHz band EFJ LTR™ - and AmeriCom- compatible FM transceiver for commercial use that can be programmed.

2. Circuit Configuration by Frequency

The TK-931A(D)/931A(HD) incorporates a PLL synthesizer that works with a digital VFO and allows a 12.5kHz channel step to be selected.

The receiver is a double-conversion superhetero-

dine one with a first intermediate frequency (IF) of 39.0375MHz and a second IF of 455kHz. Incoming signals from the antenna are mixed with the PLL output to produce the first IF, and this is mixed with the 38.5825MHz second local oscillator output to produce the second IF.

A transmit signal of 1/2 the desired frequency is generated by the PLL VCO, amplified, frequency doubled, and fed to the antenna.

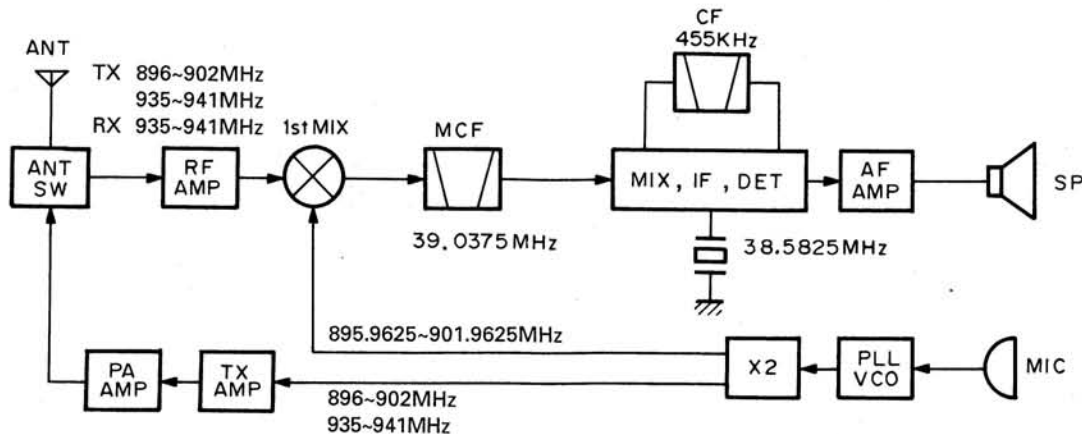


Fig. 1 Frequency configuration

3. Receiving System

3-1. RF unit

An incoming RF signal from the antenna terminal is applied to bandpass filter (L306). Pin diode D403 is turned off. The signal is amplified by RF amplifier (Q300), and passes through the bandpass filter (L305) again. The resulting signal goes to the first mixer, Q301, where it is mixed with the first local oscillator output from the frequency synthesizer to produce the first IF (39.0375MHz).

3-2. IF unit

The first IF signal then passes through a four-pole monolithic crystal filter (XF300) to limit its bandwidth. The signal is amplified by first IF amplifier Q302 and goes to the second IF unit. The second IF unit consists of IF system IC (IC300) and the second mixer, second local oscillator, IF filter, and FM detector. IC300 mixes the signal input to it with the second local oscillator

output of 39.0375MHz to produce the second IF of 455kHz. The 455kHz signal then goes through the 455kHz ceramic filter CF300, and is then amplified by the limiting amplifier, demodulated by the quadrature FM detector, and output to the receive audio amplifier.

3-3. Audio amplifier unit

The demodulated signal enters the BPF/VCA (A100 (B/3)), is amplified by IC41 (1/2), and goes through a low-pass filter consisting of IC41 (2/2), which has a 3kHz cut-off frequency, a high-pass filter consisting of IC42 (1/2), which has a 300Hz cut-off frequency, and a BEP consisting of IC42 (2/2), which has a 200Hz cut-off frequency to produce an audio signal. The signal then goes through the de-emphasis and electronic volume control circuits in IC43, and on to power amplifier IC102, where it is amplified and output to the speaker.

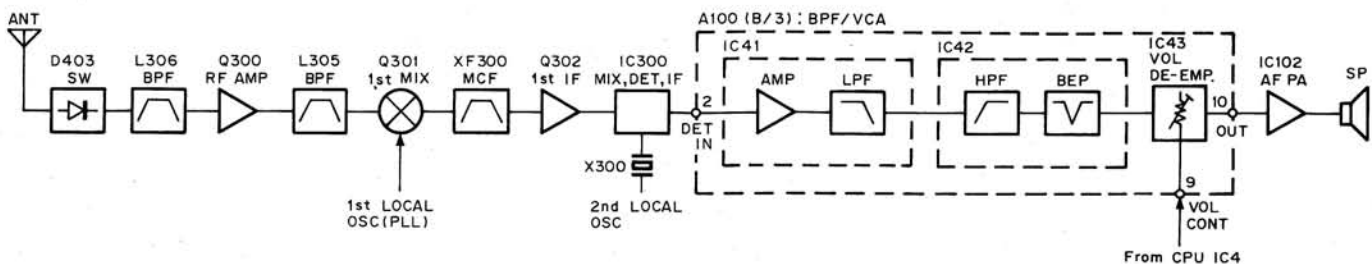


Fig. 2 Receiving system

CIRCUIT DESCRIPTION

3-4. Squelch Circuit

The receive detector output is amplified by IC41 (1/2) in the BPF/VCA (A100 (B/3)), passes through Q114 (Q115, Q114 : on in receive mode), and goes to the LBF/BPF (A100 (C/3)). The signal passes through C74, and goes to the noise amplifier IC71 (2/2), which removes the noise component from the signal. Then, Q71 converts the level of the noise pulses and applies them to CPU (IC4) pin 20. IC4 counts the pulses, performs digital integration, reads the voltage across the preset squelch potentiometer (VR1) via IC4 pin 29, compares the voltage with the integration value, and turns the squelch on or off accordingly.

3-5. AF volume control circuit

The audio level is controlled by the DC voltage applied to pin 8 of the electronic volume IC (IC43). The voltage settings are stored in the memory of microprocessor IC4, and pulses of frequency about 23.8kHz with a duty ratio corresponding to one of the settings (32 steps) are output from the VRC pin and converted to a DC voltage by the low-pass filter consisting of R122, C161, R123, and C162.

The DC voltage is used to change the balance of the differential amplifier circuit in IC43 and change gm to attenuate.

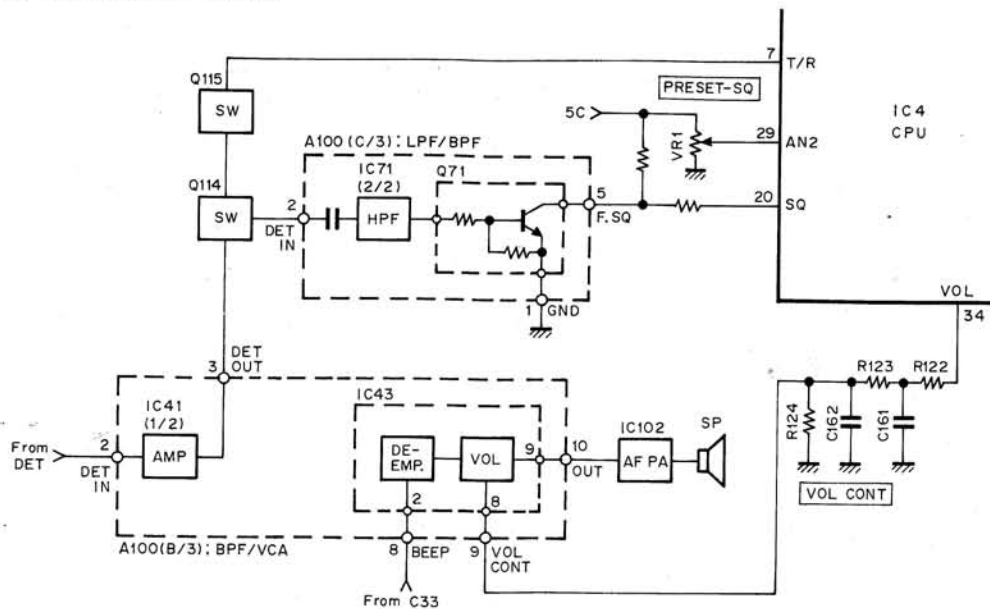


Fig. 3 Squelch and AF volume control

4. Transmitter System

4-1. Microphone amplifier

The signal from the microphone goes through the microphone gain potentiometer (VR101), enters the MIC AMP (A100 (A/3)), passes through a high-pass filter consisting of IC1 (2/2), which has a 230Hz cut-off frequency, and goes to the pre-emphasis/limiting circuit consisting of IC1 (2/2). The signal passes through a low-pass filter consisting of IC2, which has a 3.2kHz cut-off frequency, and unwanted harmonics are re-

moved. The resulting signal passes through the maximum deviation potentiometer (VR102) and is mixed with the low-speed data (LSD) encode output in the summing IC, IC3 (2/2). The output signal is switched by Q2 (Q2 on in transmit mode), and transmit mode, goes to the PLL modulator (D202) and VCXO (X200) modulation input.

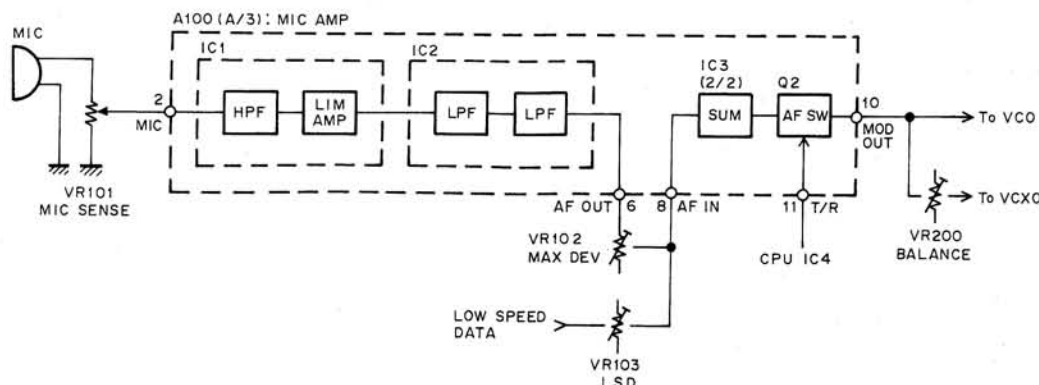


Fig. 4 Microphone amplification

TK-931A(D)/931A(HD)

CIRCUIT DESCRIPTION

4-2. Final amplifier

• TK-931A(D)

The signal from the PLL is amplified by the final module (IC400 and IC401) to an output level of 15W, and goes through the harmonic filter and antenna switch D403, and on to the antenna terminal.

• TK-931A(HD)

The signal from the PLL is amplified to an output level of 30W by the final module (IC400 and IC401) and the harmonic power amplification transistor (Q404), and goes through the harmonic filter and antenna switch D403, and on to the antenna terminal.

4-3. APC circuit

• TK-931A(D)

The direct current that flows through the final module (IC401) produces a voltage across resistors R429, R430, and R431. This voltage is applied to pin 2 of IC402 (2/2), and is input as the reference voltage difference of pin 3 and amplified.

IC402 (1/2) compares the DC input of pin 6 with the reference voltage input of pin 5, amplifies it, and controls the DC amplifier (Q402 and Q401) to keep the transmit final current constant, thus keeping the transmit output constant.

• TK-931A(HD)

The direct current that flows through the harmonic power transistor (Q404) and final module (IC401) produces a voltage across resistor R423. This voltage is applied to pin 2 of IC402 (2/2), and is input as the reference voltage difference of pin 3 and amplified.

IC402 (1/2) compares the DC input of pin 6 with the reference voltage input of pin 5, amplifies it, and controls the DC amplifier (Q402 and Q401) to keep the transmit final current constant, thus keeping the transmit output constant.

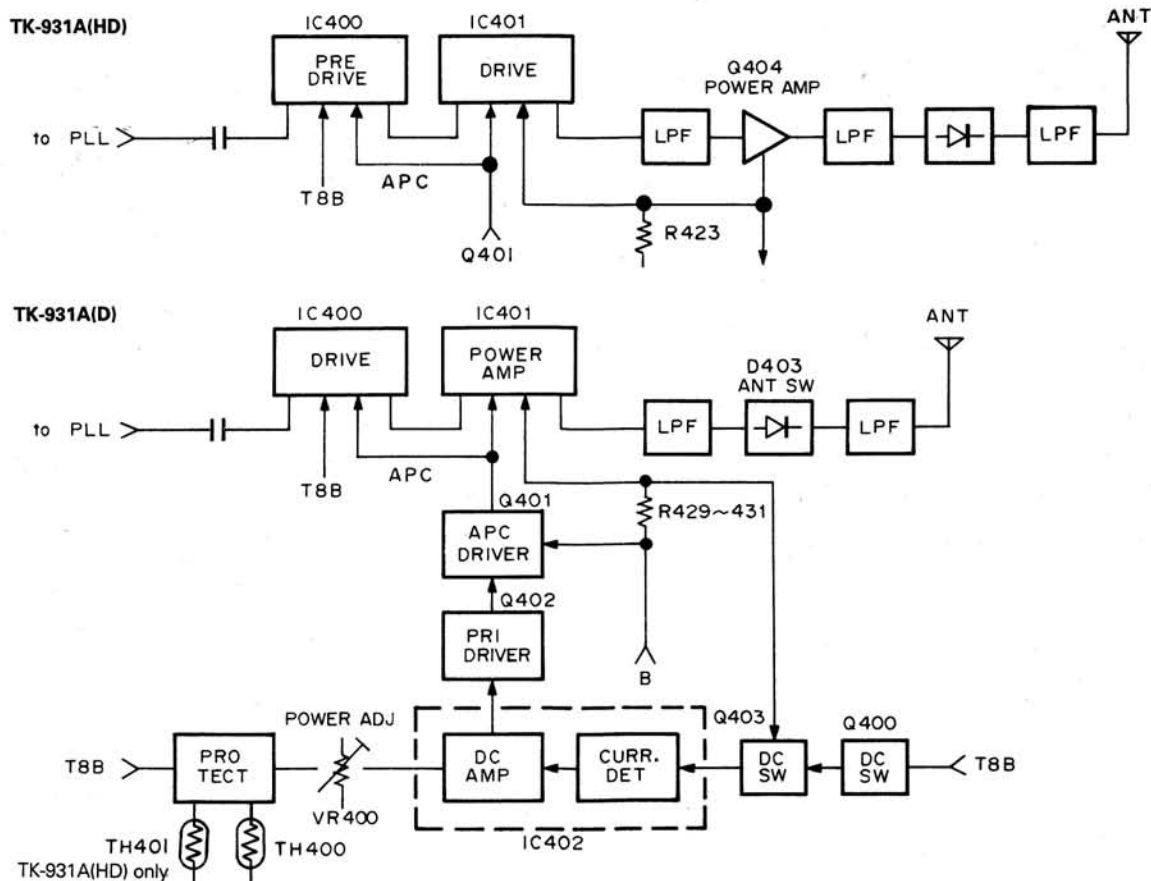


Fig. 5 Transmit power unit, APC circuit

CIRCUIT DESCRIPTION

5. Frequency Synthesizer Unit

5-1. PLL

The frequency synthesizer consists of VCXO (X200), and a VCO circuit, PLL circuit, and peripheral circuits.

The VCXO generates 12.8MHz. The frequency stability is within ± 1.5 ppm within the temperature range of -30°C to $+60^{\circ}\text{C}$. This output enters the PLL IC (IC201), and is divided by 1024 to produce a 12.5kHz reference signal.

The VCO output from the buffer amplifier (Q207) is doubled by Q202, amplified by buffer amplifier Q203, and sent to the PLL IC (IC201). The phase of this signal is compared with the 12.5kHz reference signal in IC201. The output from the phase comparator goes

through the charge pump and low-pass filter in IC201, and on to the varactor diodes (D203 and D204) in the VCO unit, keeping the VCO frequency constant. The other output from Q202 is amplified by the RF amplifier (Q200), and output to the transmit or receive unit via the RF switch (D205 and D206).

The VCO frequency shift circuit, comprising Q205, D200, and their peripheral circuits, operates during transmission only, when the talk-around mode has been selected. The VCO frequency is doubled to 39MHz and then the transmission frequency is increased by this amount.

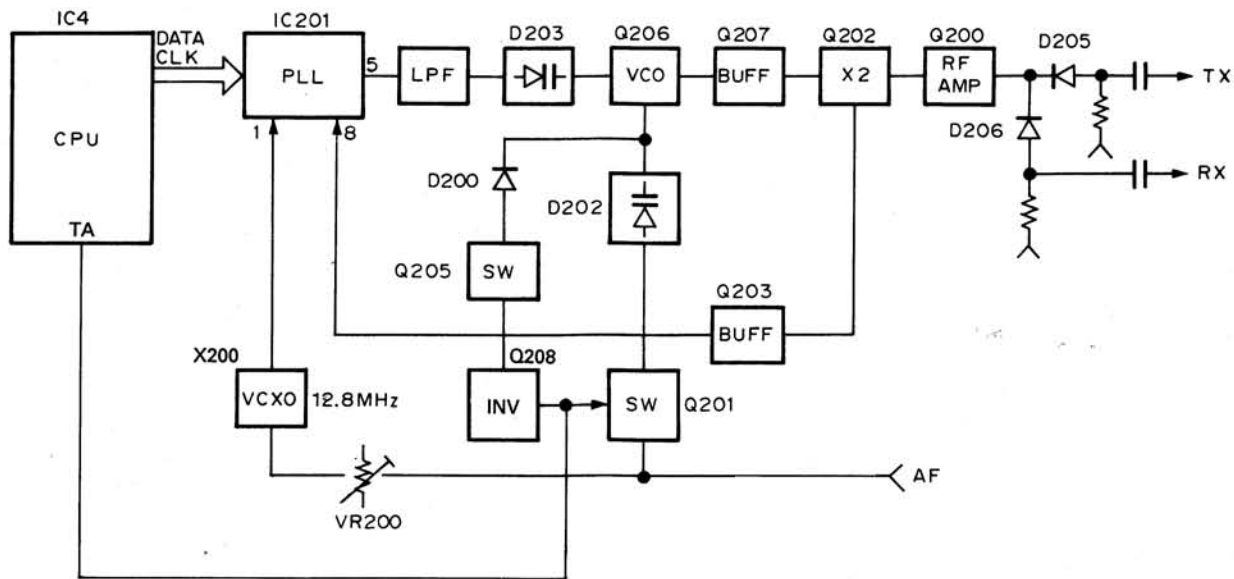


Fig. 6 PLL unit block diagram

5-2. PLL unlock

When the PLL is unlocked, the lock detect signal (LD) of IC201 is converted to a DC signal by Q204 and IC204. This signal cuts off the power line (T8B) of the transmit stage with the DC switch (Q105, Q100), stopping transmission.

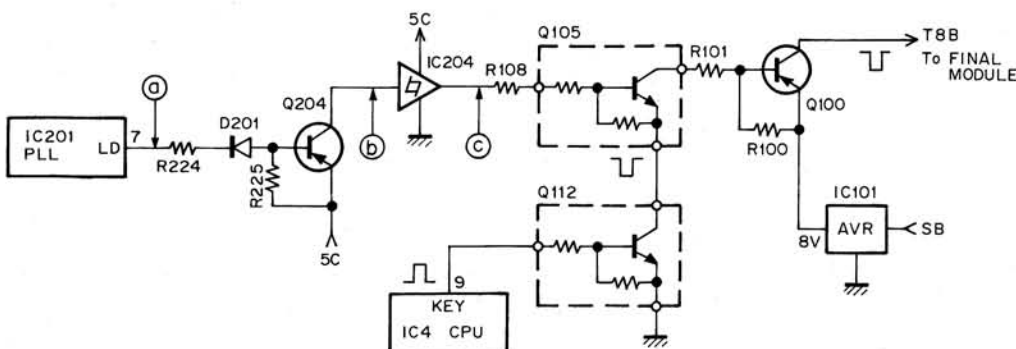
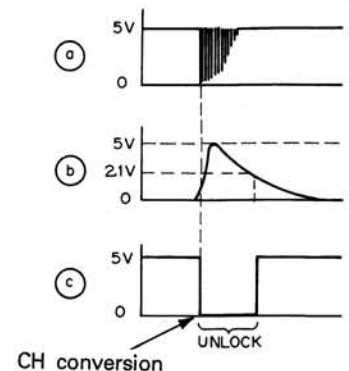


Fig. 7 PLL unlock circuit



TK-931A(D)/931A(HD)

CIRCUIT DESCRIPTION

6. Control Unit

The control unit consists of microprocessor IC4 and its peripheral circuits. It controls the TX and RX units and transfers data to and from the display assembly.

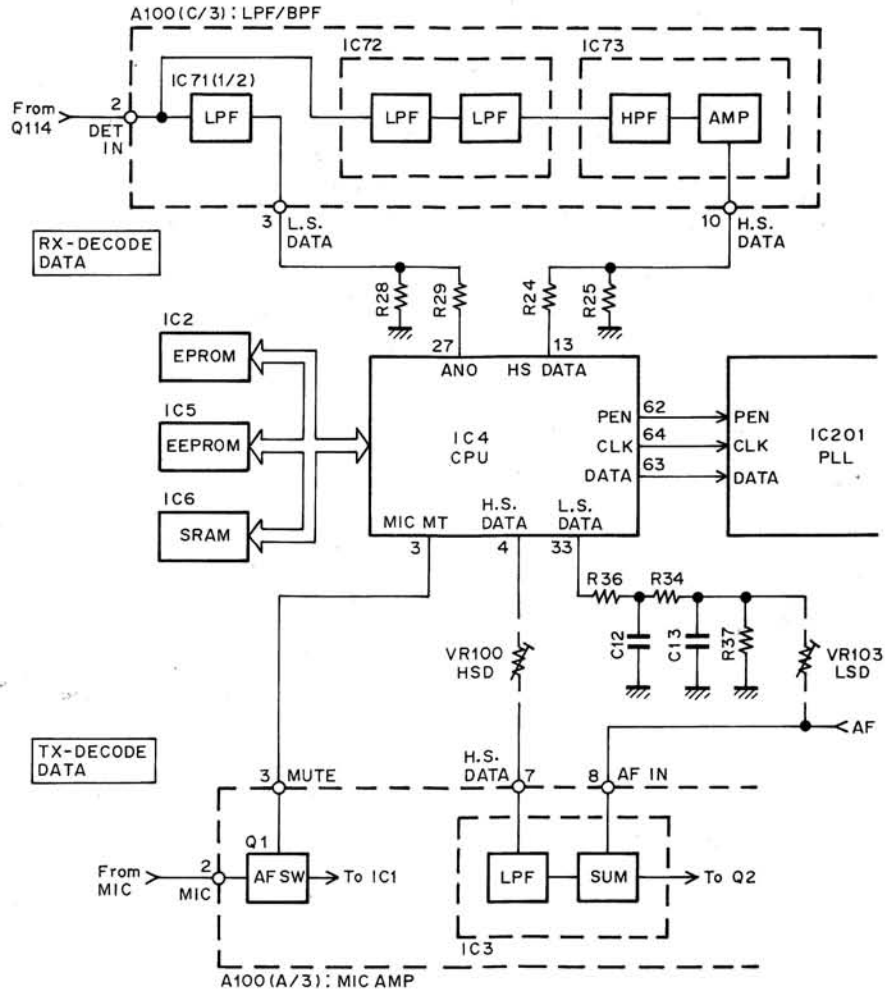


Fig. 8 Control unit block diagram

6-1. Reset circuit

As the 5V line voltage (5V) rises when the power is turned on, the reset system IC (IC1) keeps the output (pin 3) at 0V until the input voltage exceeds 4.2V.

When the voltage exceeds 4.2V, the output goes

high, and the reset voltage is applied to the CPU (IC4) via the integrator consisting of R1, R2, and C1. When this voltage exceeds 3.8V, the CPU is initialized and starts up.

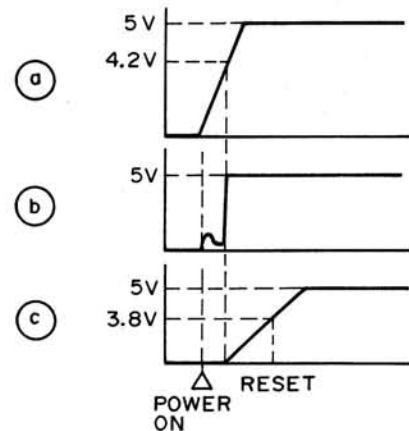
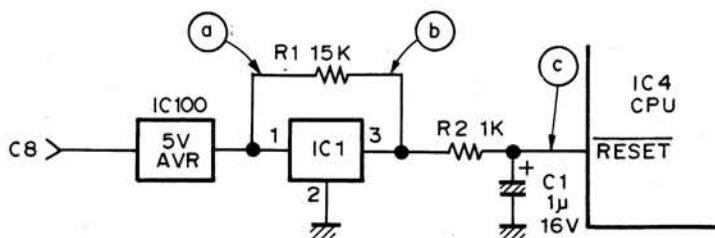


Fig. 9 Reset circuit

CIRCUIT DESCRIPTION

6-2. Memory circuit

IC2 is an EPROM with a capacity of 32K x 8 bits, in which the transceiver control program is stored as part of the CPU (IC4). Data such as transceiver channels and operating features are programmed in the EEPROM, consisting of IC5. IC 6 is a static RAM used as a data buffer.

6-3. TX encode data

The microprocessor (IC4) transmits encode data selected by the program.

- **Low-speed data (LTR format)**

Low-speed data is output from IC4 pin 33. The signal passes through a low-pass filter consisting of R36, C12, R34, and C13, is mixed with the audio output in IC3 (2/2) in the microphone amplifier (A100 (A/3)), and transmit mode, goes to the PLL modulator (D202) and VCXO (X200) modulation input. The modulation level of the low speed data can be adjusted to an appropriate value with potentiometer VR103.

- **High speed data (AmeriCom format)**

High speed data is output from IC4 pin 4. The signal passes through a low-pass filter consisting of IC3 (1/2) in the microphone amplifier (A100 (A/3)), which has a 3.16kHz cut-off frequency, passes through IC3 (2/2), and goes to the PLL modulator (D202) and VCXO (X200) modulation input. The audio signal is switched by Q1 (Q1 : on) and muted, and only high-speed data is transmitted. The modulation level of the high-speed data can be adjusted to an appropriate value with potentiometer VR100.

6-4. RX decode data

- **Low-speed data (LTR format)**

The receive detection signal sent to the LPF/BPF (A100 (C/3)) goes through low-pass filter IC71 (1/2), which has a 200Hz cut-off frequency, where audio components are removed. This signal is divided by R28 and R29 and fed to CPU (IC4) pin 27. IC4 digitizes this signal, performs processing using low-pass filtering and DC restoration, and decodes the signal.

- **High-speed data (AmeriCom format)**

The receive detection signal sent to the LPF/BPF (A100 (C/3)) goes through low-pass filter IC72, which has a 3.2kHz cut-off frequency, and high-pass filter IC73 (1/2), which has a 200Hz cut-off frequency, and the waveform is rectified. This signal is divided by R24 and R25 and fed to CPU (IC4) pin 13. IC4 reads and decodes this signal.

6-5. PLL data output

PLL data is output from the DATA (P04), CLOCK (P05), and PLL ENABLE (P07) pins of the CPU (IC4) when the channel is changed or when transmission is changed to reception or vice versa. These signals are input to the PLL IC (IC201).

6-6. Tone generator

The beeps and tones used by the TK-931A(D)/931A(HD) are generated and mixed, and their frequencies (about 700Hz, 900Hz, and 1500Hz) are determined by the microprocessor (IC4). The 700Hz or 1500Hz square wave is output from the PIN33/ALT2 output pin, and the 900Hz square wave is output from the PIN35/ALT1 output pin. The signals are rectified by the network consisting of R31 to R33, C23, and C24, and fed to IC43 in BPF/VCA via C33.

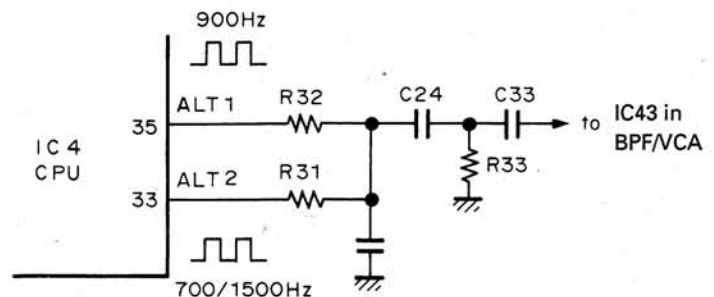


Fig. 10 Tone generator circuit

TK-931A(D)/931A(HD)

CIRCUIT DESCRIPTION

6-7. Horn control (Q109, Q111)

The horn switch, consisting of Q109 and Q111, controls the horn relay supplied by the dealer to provide the horn alert function. Normally, Q109 is on and the base of Q111 is about 0V, so Q111 is off.

If the horn alert is enabled when the ignition sense input (CN2 : IG) is off and microphone is on hook, CPU (IC4) pin 1 goes low, and Q109 turns off. As a result,

the base current flows to Q111 via R121, and Q111 turns on. The maximum sink current of Q111 is 800 mA.

Note : The horn relay can be controlled even if the ignition sense input (IG) is on and the microphone is off hook. (See page 18 Modification.)

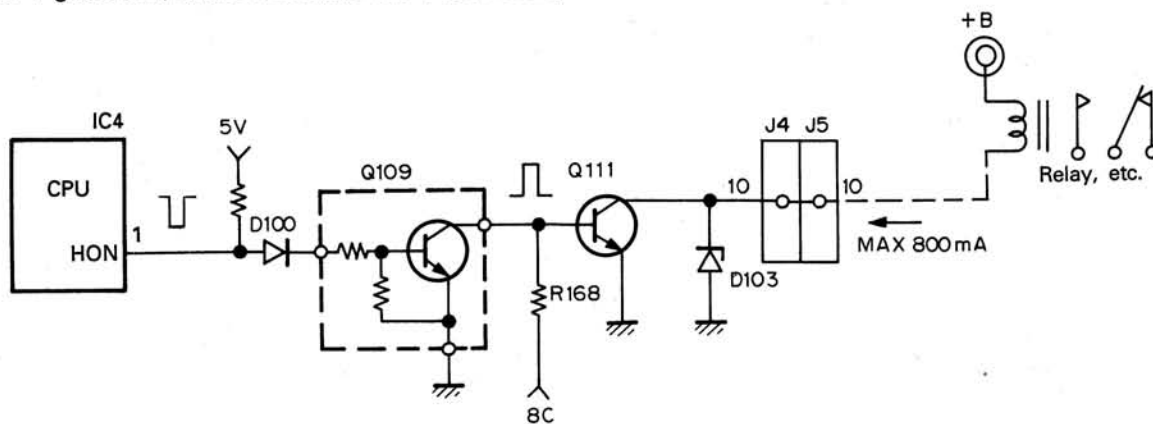


Fig. 11 Horn control circuit

6-8. Power switch circuit (semiconductor switch)

The power switch consists of Q103, Q104, and its peripheral circuits.

If pin 1 of CN1 connected to the LCD assembly goes low, Q104 and Q103 turn on and +B (13.6V) is supplied.

Note : Q104 and Q103 can be turned on by turning ignition sense input (CN2 : IG) on (Q116 : on). (See page 18 Modification.)

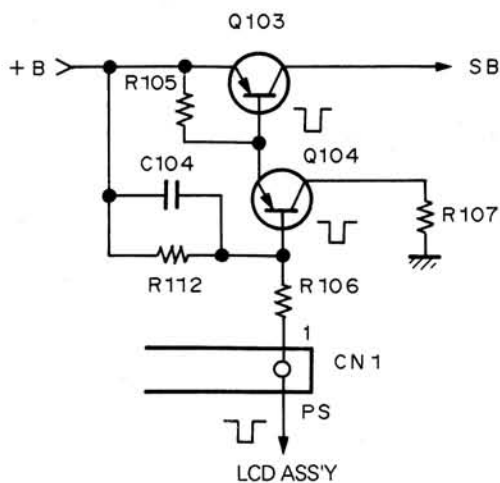


Fig. 12 Power switch circuit

6-9. Audio muting

Audio muting is controlled by making CPU (IC4) pin 2 and pin 59 high and turning Q106 BPF/VCA (A100 (B/3)) Q41 on. To output a beep or alert tone, Q106 turns off and Q41 turns on.

7. LCD assembly

The display assembly consists of the CPU, LCD, power switch circuit, and peripheral circuits.

7-1. CPU

The CPU (IC1) mainly does the following:

AF volume : Transmits on/off serial data from the AF volume UP/DOWN switch, system UP/DOWN switch, group UP/DOWN switch, SCAN switch, and A (AUX) switch to the TX/RX unit.

Receives serial data from the TX/RX unit and displays the data directly on the LCD. The LCD contains the system (7-segment), group (7-segment), transmission, BUSY, CALL, SCAN, and AUX indicators.

7-2. LCD drive

The LCD drive IC (IC2) drives the alphanumeric display, performing dynamic operation with a 1/2 duty ratio. Display data is received on PIN62/DATA, PIN61/CLK, and PIN60/CE of IC2.

7-3. Power switch circuit

The power switch circuit consists of a D-type flip-flop (IC4), inverter (IC6), transistor (Q1), diode (D2), and peripheral circuits. It is toggled on and off by the momentary-touch power switch (SW1).

TK-931A(D)/931A(HD)

DESCRIPTION OF COMPONENTS

TX-RX UNIT (X57-3930-11) : TK-931A(D)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC1	M51943BML	Precision references	
IC2	C256B-15XF1JCL1	EPROM	(M27)
IC3	HD74HC373FP	Octal transparent latch	
IC4	μPD78310AGF	Microprocessor	
IC5	HN58C65FP-25T	EEPROM	
IC6	HM6264ALFP-15T	SRAM	
IC7	TC7S00F	NAND	
IC8	TC7S32F	OR	
IC100	NJM78L05UA	Voltage regulator	5V
IC101	μPC7808H	Voltage regulator	8V
IC102	μPC1242H	AF power amplifier	
IC201	MB1501F	PLL system	
IC203	TC4S66F	Analog switch	
IC204	TC4S584F	Schmitt inverter	
IC300	MC3361D	IF system	
IC400	M57781	TX driver	
IC401	MHW820-3	TX power amplifier	
IC402	NJM2904M	DC amplifier	APC
Q100	2SB1119S	DC switch	T8B
Q101	2SC2712(GR)	Ripple filter	SC7
Q102	2SB1119S	DC switch	T8A
Q103	2SB1302S	DC switch	SB
Q104	2SA1162(Y)	DC switch	
Q105	DTC114EK	DC switch	
Q106	DTC314TK	Muting switch	
Q108,109	DTC114EK	DC switch	
Q111	2SD1624(S,T)	DC switch	
Q112,113	DTC114EK	DC switch	
Q114	2SA1162(Y)	Muting switch	
Q115,116	2SC2712(Y)	DC switch	
Q200	2SC3356	RF amplifier	
Q201	DTC314TK	AF switch	
Q202	2SC3356	Doubler	
Q203	2SC3356	RF amplifier	
Q204	2SA1162(Y)	DC amplifier	
Q205	DTA114EK	DC switch	
Q206	2SK508NV(52K)	Oscillator	
Q207	2SC3356	Buffer amplifier	
Q208	DTC114EK	DC switch	
Q300	2SC4093	RF amplifier	
Q301	3SK184(R)	Mixer	
Q302	2SK302(GR)	IF amplifier	
Q400	DTC114EK	DC switch	
Q401	2SB967(Q)	DC amplifier	APC
Q402	2SC2712(Y)	DC amplifier	
Q403	DTA114EK	DC switch	

DESCRIPTION OF COMPONENTS

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
D1~4	1SS226	Voltage clamp	
D5	RD5.1M-B1	Voltage clamp	
D6~9	1SS226	Voltage clamp	
D100,101	1SS184	Current steering	
D102	1SS226	Level shifter	
D103	RD20M-B1	Voltage clamp	
D104	1SS181	Current steering	
D200	HSK277	RF switch	
D201	1SS184	DC isolation	
D202	1SV164	Varactor	Modulator
D203,204	1T33C	Varactor	Tuning
D205	1SV128	RF switch	For TX
D206	1SV128	RF switch	For RX
D300	1SS184	Current steering	
D400	ERZ-M10DK220	Surge absorber	
D401	DSA3A1	Protection	Reverse polarity protection
D402	1SS184	Current steering	
D403	MI407	RF switch	
D404	MI308	RF switch	
D405	MI808	RF switch	

TX-RX UNIT (X57-3940-11) : TK-931A(HD)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC1	M51943BML	Precision references	
IC2	C256B-15XF1JCL1	EPROM	(M27)
IC3	HD74HC373FP	Octal transparent latch	
IC4	μPD78310AGF	Microprocessor	
IC5	HN58C65FP-25T	EEPROM	
IC6	HM6264ALFP-15T	SRAM	
IC7	TC7S00F	NAND	
IC8	TC7S32F	OR	
IC100	NJM78L05UA	Voltage regulator	5V
IC101	μPC7808H	Voltage regulator	8V
IC102	μPC1242H	AF power amplifier	
IC201	MB1501F	PLL system	
IC203	TC4S66F	Analog switch	
IC204	TC4S584F	Schmitt inverter	
IC300	MC3361D	IF system	
IC400	M57781	TX pre-driver	
IC401	MHW820-3	TX driver	
IC402	NJM2904M	DC amplifier	APC
Q100	2SB1119S	DC switch	T8B
Q101	2SC2712(GR)	Ripple filter	SC7
Q102	2SB1119S	DC switch	T8A
Q103	2SB1302S	DC switch	SB
Q104	2SA1162(Y)	DC switch	
Q105	DTC114EK	DC switch	
Q106	DTC314TK	Muting switch	
Q108,109	DTC114EK	DC switch	

TK-931A(D)/931A(HD)

DESCRIPTION OF COMPONENTS

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
Q111	2SD1624(S,T)	DC switch	
Q112,113	DTC114EK	DC switch	
Q114	2SA1162(Y)	Muting switch	
Q115,116	2SC2712(Y)	DC switch	
Q200	2SC3356	RF amplifier	
Q201	DTC314TK	AF switch	
Q202	2SC3356	Doubler	
Q203	2SC3356	RF amplifier	
Q204	2SA1162(Y)	DC amplifier	
Q205	DTA114EK	DC switch	
Q206	2SK508NV(52K)	Oscillator	
Q207	2SC3356	Buffer amplifier	
Q208	DTC114EK	DC switch	
Q300	2SC4093	RF amplifier	
Q301	3SK184(R)	Mixer	
Q302	2SK302(GR)	IF amplifier	
Q400	DTC114EK	DC switch	
Q401	2SB967(Q)	DC amplifier	APC
Q402	2SC2712(Y)	DC amplifier	
Q403	DTA114EK	DC switch	
Q404	MRF847	TX power amplifier	
Q405	DTC114EK	DC switch	
D1~4	1SS226	Voltage clamp	
D5	RD5.1M-B1	Voltage clamp	
D6~9	1SS226	Voltage clamp	
D100,101	1SS184	Current steering	
D102	1SS226	Level shifter	
D103	RD20M-B1	Voltage clamp	
D104	1SS181	Current steering	
D200	HSK277	RF switch	
D201	1SS184	DC isolation	
D202	1SV164	Varactor	Modulator
D203,204	1T33C	Varactor	Tuning
D205	1SV128	RF switch	For TX
D206	1SV128	RF switch	For RX
D300	1SS184	Current steering	
D301	HSM88ASR	Protection	
D400	ERZ-M10DK220	Surge absorber	
D401	DSA3A1	Protection	Reverse polarity protection
D402	1SS184	Current steering	
D403	UM9401	RF switch	
D404	MI308	RF switch	
D405	MI808	RF switch	
D406	HSM88ASR	Detector	
D407	1SS184	Current steering	

DESCRIPTION OF COMPONENTS

MIC AMP (X59-3950-10) (A/3) : TK-931A(D), TK-931A(HD)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC1	NJM4558M	MIC amplifier/Limiter	IDC
IC2	NJM4558M	Active filter	
IC3	NJM4558M	Active filter/Summing amplifier	HS. data
Q1	DTC314TK	Muting switch	
Q2	DTA114EK	Muting switch	

BPF/VCA (X59-3950-10) (B/3) : TK-931A(D), TK-931A(HD)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC41	NJM4558M	Audio amplifier/Active filter	
IC42	NJM4558M	Active filter	
IC43	M5282FP	Electronic attenuator	
Q41	DTC314TK	Muting switch	

LPF/BPF (X59-3950-10) (C/3) : TK-931A(D), TK-931A(HD)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC71	NJM4558M	Active filter	LS. data/F. SQ
IC72,73	NJM4558M	Active filter	
Q71	DTC114EK	Noise amplifier	F. SQ

LCD ASS'Y (B38-0332-15) : TK-931A(D), TK-931A(HD)

Ref No.	Parts No.	Use/Function	Operation/Condition/Compatibility
IC1	75304GF-104	Microprocessor	
IC2	LC7582	LCD driver	
IC3	L78M05T-FA	Voltage regulator	+5V
IC4	TC4013BF	D-type flip flop	
IC5	M51943BML	Precision references	
IC6	TC4SU69F	Inverter	
Q1	2SC2712(GR)	DC switch	
D1,2	1SS184	Current steering	
D3	1SS226	Voltage clamp	MRX
D4	1SS226	Voltage clamp	PTT (EXT)
D5	1SS226	Voltage clamp	MTX
D6	1SS226	Voltage clamp	HOOK (EXT)
D7	RD18M-B2	Voltage clamp	
D8	B38-0336-08	LED	Orange
LCD1	B38-0334-08	LCD	Indicator

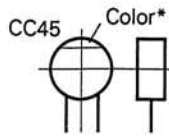
TK-931A(D)/931A(HD)

PARTS LIST

CAPACITORS

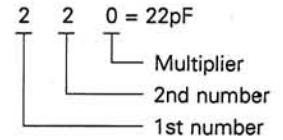
CC 45 TH 1H 220 J
 1 2 3 4 5 6

- 1 = Type ... ceramic, electrolytic, etc.
- 2 = Shape ... round, square, ect.
- 3 = Temp. coefficient
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance



Capacitor value

- 010 = 1pF
- 100 = 10pF
- 101 = 100pF
- 102 = 1000pF = 0.001μF
- 103 = 0.01μF



Temperature coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

Example : CC45TH = -470 ± 60ppm/°C

Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10μF - 10 ~ +50 Less than 4.7μF -10 ~ +75

Less than 10pF

Code	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

Voltage rating

2nd word	A	B	C	D	E	F	G	H	J	K	V	
1st word	0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35	
2	100	125	160	200	250	315	400	500	630	800	-	
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-	

Chip capacitors

(EX) C C 7 3 F S L 1 H 0 0 0 J
 1 2 3 4 5 6 7
 (Chip) (CH, RH, UJ, SL) Refer to the table above.

(EX) C K 7 3 F F 1 H 0 0 0 Z
 1 2 3 4 5 6 7
 (Chip) (B, F)

Dimension

Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

RESISTORS

Chip resistor (Carbon)

(EX) R D 7 3 E B 2 B 0 0 0 J
 1 2 3 4 5 6 7
 (Chip) (B,F)

Carbon resistor (Normal type)

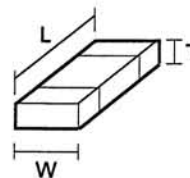
(EX) R D 1 4 B B 2 C 0 0 0 J
 1 2 3 4 5 6 7

- 1 = Type ... ceramic, electrolytic, etc.
- 2 = Shape ... round, square, ect.
- 3 = Dimension
- 4 = Temp. coefficient
- 5 = Voltage rating
- 6 = Value
- 7 = Tolerance

Rating wattage

Code	Wattage	Code	Wattage	Code	Wattage
2A	1/10W	2E	1/4W	3A	1W
2B	1/8W	2H	1/2W	3D	2W
2C	1/6W				

Dimension



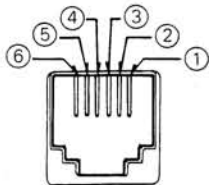
TK-931A(D)/931A(HD)

ADJUSTMENT

Test Equipment Required for Alignment

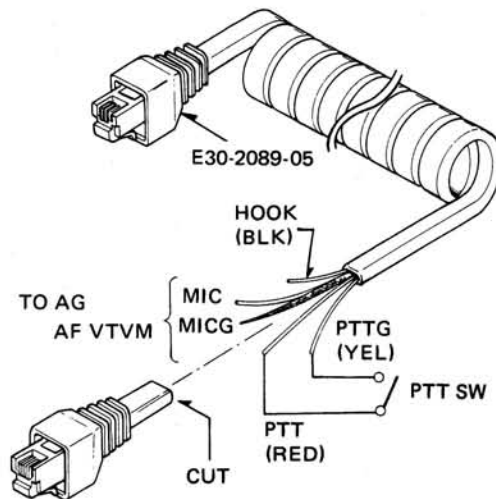
No.	Test Equipment	Major Specifications
1	Standard Signal Generator (SSG)	Frequency Range: 850 to 941MHz. Modulation: Frequency modulation and external modulation. Output: 0.1μV to greater than 1mV.
2	Power Meter	Input Impedance: 50Ω. Operation Frequency: 800 to 950MHz or more. Measurement Capability: Vicinity of 100W.
3	Deviation Meter	Frequency Range: 800 to 950MHz.
4	Digital Volt Meter (DVM)	Measuring Range: 1 to 10V DC. Accuracy: High input impedance for minimum circuit loading.
5	Oscilloscope	DC through 30MHz.
6	High Sensitivity Frequency Counter	Frequency Range: 10Hz to 1000MHz. Frequency Stability: 0.2ppm or less.
7	Ammeter	30A.
8	AF Volt Meter (AFVTVM)	Frequency Range: 50Hz to 10kHz. Voltage Range: 3mV to 3V.
9	Audio Generator (AG)	Frequency Range: 50Hz to 5kHz or more. Output: 0 to 1V.
10	Distortion Meter	Capability: 3% or less at 1kHz. Input Level: 50mV to 10Vrms.
11	Voltmeter	Measuring Range: 10 to 1.5V DC or less. Input Impedance: 50kΩV or greater.
12	4Ω Dummy Load	Approx. 4Ω, 3W.
13	Regulated Power Supply	13.6V, approx. 30A (adjustable from 9 to 17 V). Useful if ammeter equipped.

MIC connector front view

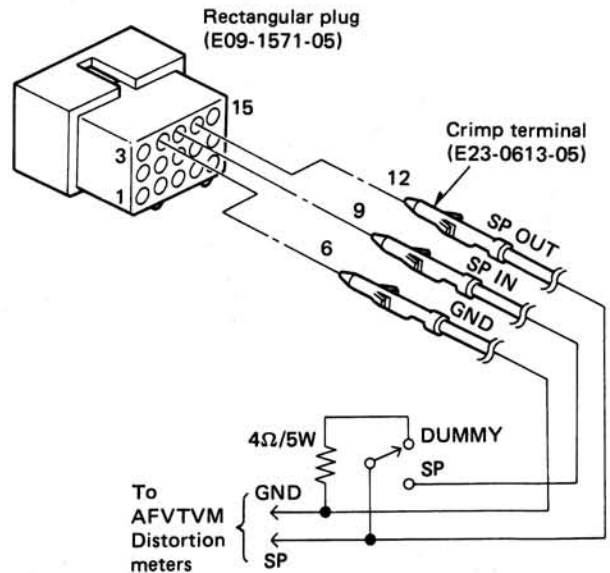


- ① SB
- ② PTTG
- ③ PTT
- ④ MICG
- ⑤ MIC
- ⑥ HOOK

• The following test cables are recommended.



Test cable for Microphone input



Test cable for Speaker output

ADJUSTMENT

The set has been adjusted for the frequencies shown in the following table.
When required, re-adjust them following the adjustment procedure to obtain the frequencies you want in actual operation.

SW100 test mode

		GRP 1	GRP 2	GRP 3	GRP 4	GRP 5
SYS 1	TX(MHz)	896.0000	896.0000	896.0000	896.0000	896.0000
	RX (MHz)	935.0000	935.0000	935.0000	935.0000	935.0000
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 2	TX (MHz)	896.0250	896.0250	896.0250	896.0250	896.0250
	RX (MHz)	935.0250	935.0250	935.0250	935.0250	935.0250
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 3	TX (MHz)	899.0000	899.0000	899.0000	899.0000	899.0000
	RX (MHz)	938.0000	938.0000	938.0000	938.0000	938.0000
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 4	TX (MHz)	899.0250	899.0250	899.0250	899.0250	899.0250
	RX (MHz)	938.0250	938.0250	938.0250	938.0250	938.0250
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 5	TX (MHz)	900.9875	900.9875	900.9875	900.9875	900.9875
	RX (MHz)	939.9875	939.9875	939.9875	939.9875	939.9875
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 6	TX (MHz)	901.4000	901.4000	901.4000	901.4000	901.4000
	RX (MHz)	940.4000	940.4000	940.4000	940.4000	940.4000
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 7	TX (MHz)	901.9000	901.9000	901.9000	901.9000	901.9000
	RX (MHz)	940.9000	940.9000	940.9000	940.9000	940.9000
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 8	TX (MHz)	897.2500	897.2500	897.2500	897.2500	897.2500
	RX (MHz)	936.2500	936.2500	936.2500	936.2500	936.2500
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 9	TX (MHz)	900.3000	900.3000	900.3000	900.3000	900.3000
	RX (MHz)	939.3000	939.3000	939.3000	939.3000	939.3000
	TONE	-	LTR	ACLS	ACHS	100Hz square wave
SYS 0	TX (MHz)	936.7500	936.7500	936.7500	936.7500	936.7500
	RX (MHz)	975.7500	975.7500	975.7500	975.7500	975.7500
	TONE	-	LTR	ACLS	ACHS	100Hz square wave

TK-931A(D)/931A(HD)

ADJUSTMENT

Test Mode

The TK-931A(D) and TK-931A(HD) transceivers have a test mode.

To enter the test mode, set button SW100 on the TX-RX unit to the TEST position. When the power is buttoned on with the button set to this position, the test mode is entered. To exit the test mode, reset the button to the NORMAL position, and turn the power off and then back on again. The mode will not be changed merely by resetting the switch. The following functions are available in the test mode.

- **SYSTEM button**

The SYSTEM button is used to select up to ten preprogrammed test frequencies.

- **GROUP button**

The following modulation signals can be selected.

Group	Modulation
1	No modulation
2	LTR format data
3	ACLS format data
4	ACHS format data
5	100Hz square wave

- **A button**

When the A button is pressed in the test mode, the transmitter enters the talk-around mode to transmit with the receive frequency, and the Auxiliary indicator lights.

- **B button**

In test mode, the receiver operates with carrier squelch. When the B button is pressed, the data decode function set in groups 2 and 4 is added.

- **C button**

If the C button is pressed in the test mode, carrier squelch is turned off. If there is no signal noise is output by the speaker and the BUSY indicator lights.

- **S button**

When the S button is pressed in the test mode, scanning occurs. A dash (-) appears on the system and group displays, and all programmed test frequencies are scanned.

- **Alphanumeric display**

The alphanumeric display shows the frequency on which the radio operates in test mode.

- **Transmitter**

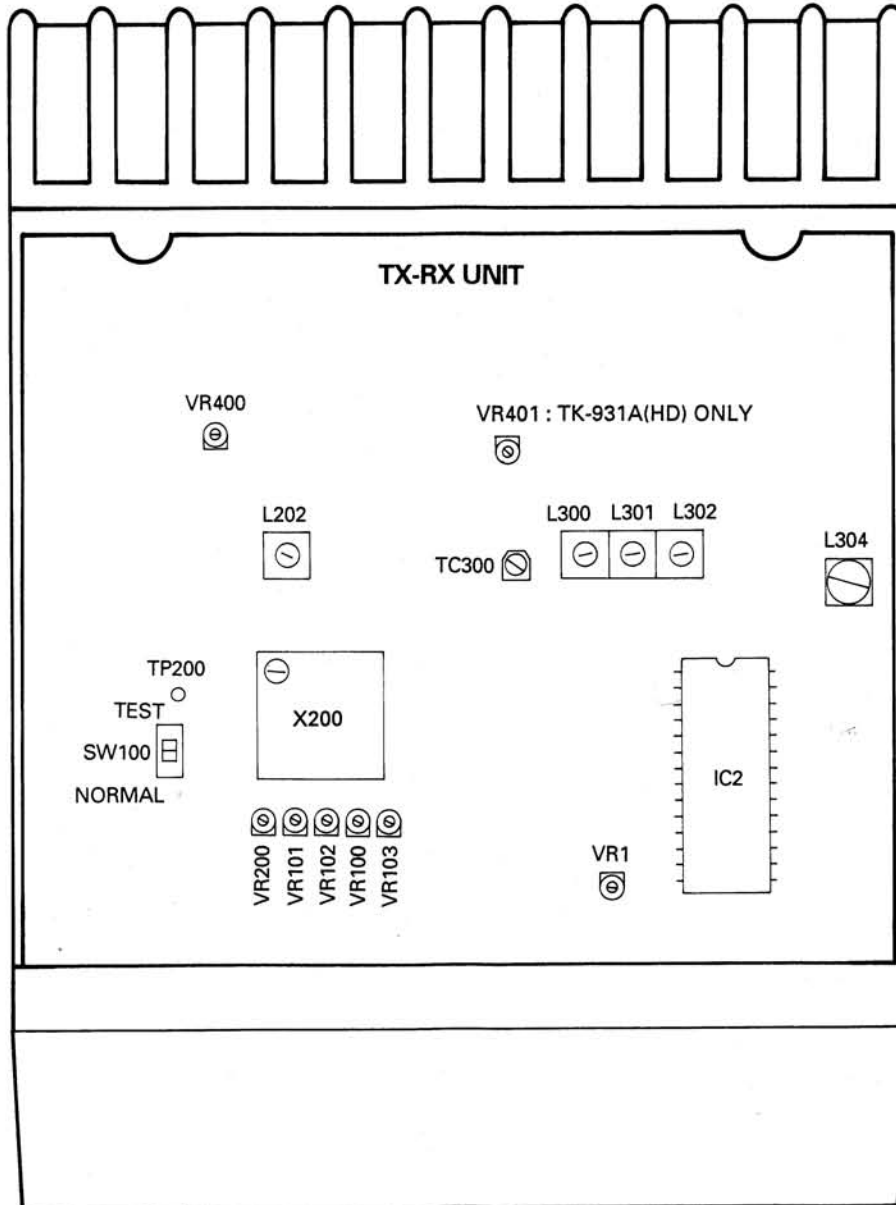
The transmitter is keyed using the microphone PTT button.

The modulation signal selected with the GROUP button is transmitted.

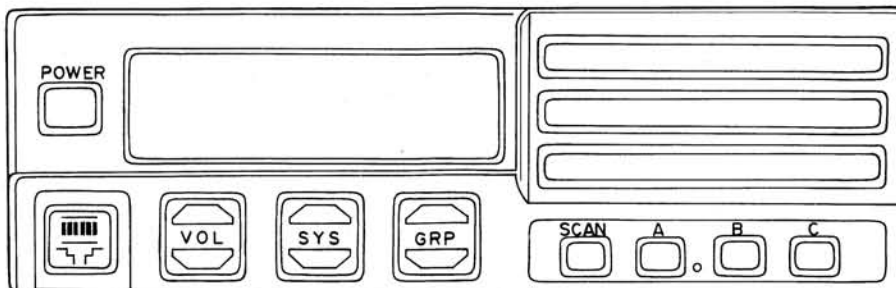
ADJUSTMENT

Adjustment Location

Top view



Front panel view




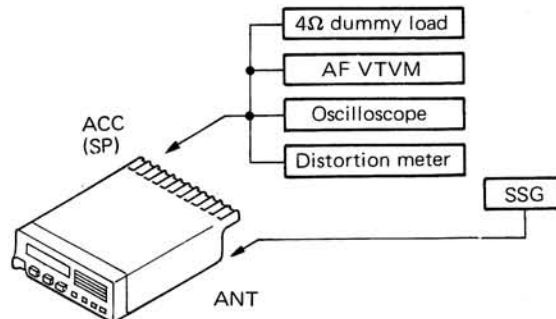
ADJUSTMENT

Alignment

Item	Condition	Measurement			Adjustment			Specifications/Remarks	
		Test-equipment	Unit	Terminal	Unit	Parts	Method		
1. Setting	1) Connect the power cable to the rear panel. TX-RX unit SW100 : TEST MODE Power SW : ON								
2. PLL lock voltage	1) CH : SYS 3 (938MHz) GRP 1	DVM Power meter	TX-RX	TP200	TX-RX	L202	4V	±0.1V	
	2) CH : SYS 1 (935MHz) GRP 1							Check	1.0V or more.
	3) CH : SYS 7 (940.9MHz) GRP 1								7.0V or less.
	4) CH : SYS 1, GRP 1 A SW : ON PTT : ON								1.0V or more.
	5) CH : SYS 7, GRP 1 PTT : ON								7.0V or less.
	6) A SW : OFF								
3. Frequency adjustment (TCXO)	1) CH : Channel with TX freq . PTT : ON Note : TCXO is adjusted precisely at 25°C. If it is readjusted, the frequency stability is changed. Do not touch it normally.	Power meter f. counter	Rear panel	ANT	TX-RX	X200	Freq' adj. of TX.	±50Hz	
	2) CH : Check other channel PTT : ON							Check	
4. Power adjustment	1) CH : SYS 4, GRP 1 (Channel with TX center freq') PTT : ON	Power meter Ammeter	Rear panel	ANT	TX-RX	VR400	MAX CW.	16.5W or more : TK-931A(D) 33W or more : TK-931A(HD)	
							MAX CCW.	4W or less : TK-931A(D) 12W or less : TK-931A(HD)	
							16W : TK-931A(D) 31W : TK-931A(HD)	±1W 6.5A or less : TK-931A(D) 12A or less : TK-931A(HD)	
	2) PTT : ON ANT : Short					VR401	Adjust for minimum current : TK-931A(HD) only	8A or less	
3) CH : SYS 1, 7 GRP 1 (Channel with lowest TX freq', and channel with highest TX freq') PTT : ON			Check	12~18W less than : TK-931A(D) 24~36W less than : TK-931A(HD) 6.5A or less : TK-931A(D) 12A or less : TK-931A(HD)					
4) A SW : ON									

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
	5) CH : SYS 1, 4, 7 GRP 1 PTT : ON 6) A SW : OFF	Power meter Ammeter	Rear panel	ANT			Check.	10~18W less than : TK-931A(D) 20~36W less than : TK-931A(HD)
5. Modulation balanced	1) MIC input : OFF Deviation meter filter LPF : 3kHz HPF : OFF De-emphasis : OFF CH : SYS 4, GRP 5 PTT : ON	Power meter Deviation meter AF VTVM AG Oscilloscope	Rear panel	ANT	TX-RX	VR200	Make the de-modulation waveform neat.	
6. LTR maximum deviation	1) MIC input : OFF Deviation meter filter LPF : 3kHz HPF : OFF De-emphasis : 750μs (P-P)/2 CH : SYS 4, GRP 2 PTT : ON					VR103	1.0kHz	±100Hz
7. AmeriCom Hi-speed	1) MIC input : OFF CH : SYS 4, GRP 4 PTT : ON Deviation meter filter LPF : 15kHz HPF : OFF De-emphasis : OFF	Power meter Deviation meter	Rear panel	ANT	TX-RX	VR100	1.75kHz	±0.1kHz
8. Maximum deviation adjustment	1) Connect AG to the MIC terminal. AG : 1kHz/50mV Deviation meter filter LPF : 15kHz HPF : OFF De-emphasis : OFF CH : SYS 4, GRP 1 PTT : ON	Power meter Deviation meter AF VTVM AG Oscilloscope	Rear panel	ANT	TX-RX	VR102	1.7kHz Adjust one more than the other by switching between -P and +P.	±100Hz
9. MIC sensitivity adjustment	1) AG : 1kHz/2.5mV Deviation meter filter LPF : 15kHz HPF : OFF De-emphasis : 750μs (P-P)/2 PTT : ON					VR101	0.75kHz	±100Hz
10. Sensitivity adjustment	1) CH : SYS 4, GRP 1 (Channel with RX center freq' (f _{RM})) SCAN SW : ON (BUSY)	SSG AF VTVM Distortion meter Oscilloscope	Rear panel	ACC (EXT.SP)				
	2) SSG freq' : f _{RM} Output : -10dBμ/0.32μV/-117dBm MOD : 1kHz DEV : ±2.5kHz				TX-RX	L304 L302	Adjust for maximum AF output.	



TK-931A(D)/931A(HD)

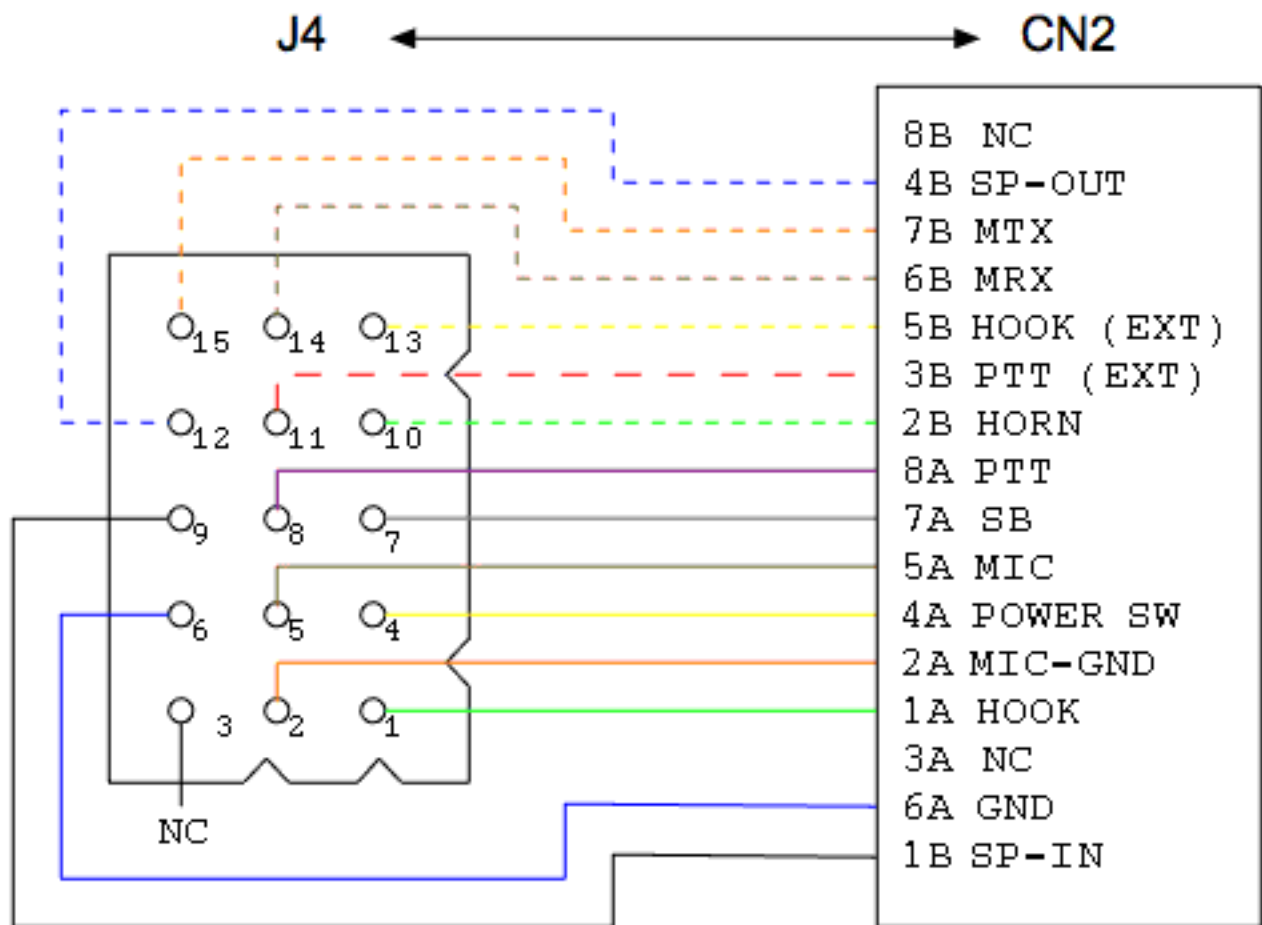
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
	3) SSG output : -6dB μ /0.5 μ V/-113dBm MOD : 1kHz DEV : \pm 2.5kHz	SSG AF VTVM Distortion meter	Rear panel	ACC (EXT.SP)	TX-RX	L300 L301	Adjust for minimum distortion.	
	4) SSG output : -10dB μ /0.32 μ V/-117dBm MOD : OFF	Oscilloscope				TC300	Adjust for minimum noise.	
	5) SSG output : -10dB μ /0.32 μ V/-117dBm MOD : 1kHz DEV : \pm 1.5kHz						Check	SINAD 12dB or more.
	6) CH : SYS 2, 6 GRP 1 (Channel with lowset RX freq' (fRL), and channel with highest RX freq' (fRH)) SSG freq' : fRL and fRH Output : -10dB μ /0.32 μ V/-117dBm MOD : 1kHz DEV : \pm 1.5kHz						Check	SINAD 12dB or more.
11. Squelch adjustment	1) CH : SYS 4, GRP 1 SSG freq' : fRM Output : Value when 3dB is subtracted from the sensitivity value of 12dB SINAD. MOD : 1kHz DEV : \pm 1.5kHz SCAN SW : OFF	SSG AF VTVM Oscilloscope	Rear panel	EXT.SP	TX-RX	VR1	Set to threshold point.	
	2) SSG output : -11dB μ /0.28 μ V/-118dBm						Check	Squelch must be open.
	3) SSG output : Value when 3dB is subtracted from the sensi- tivity value of 12dB SINAD.							Squelch must be closed.

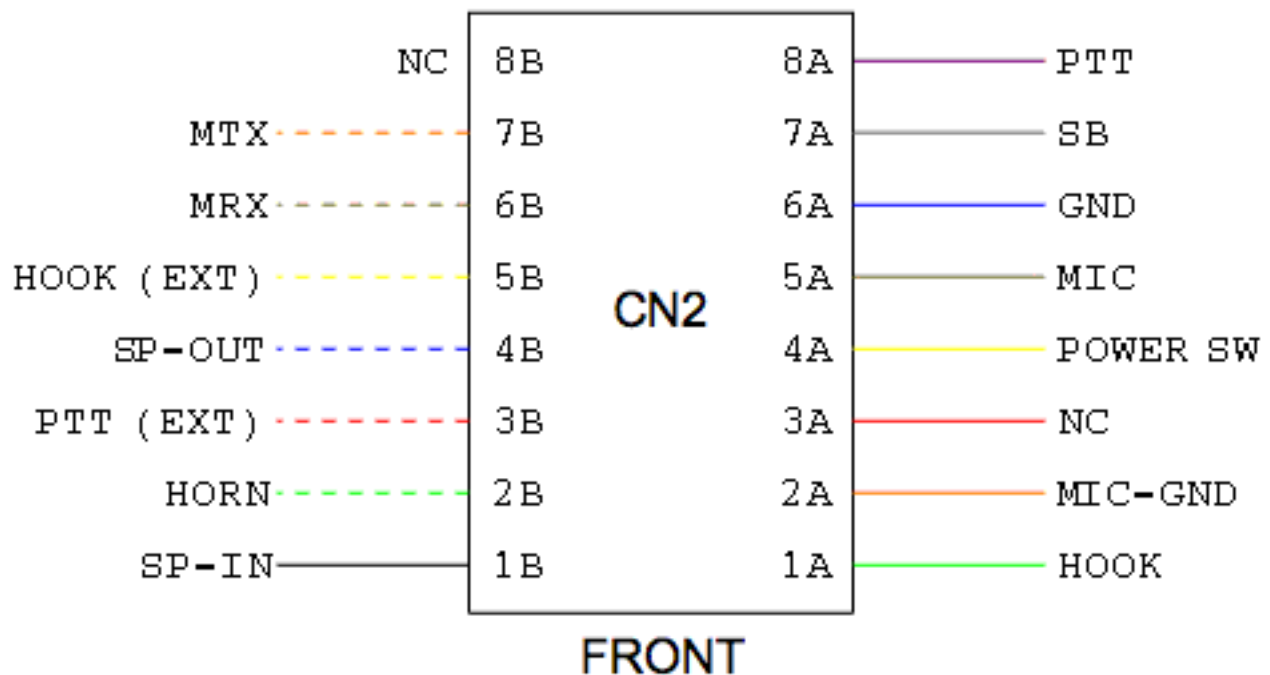
TERMINAL FUNCTIONS

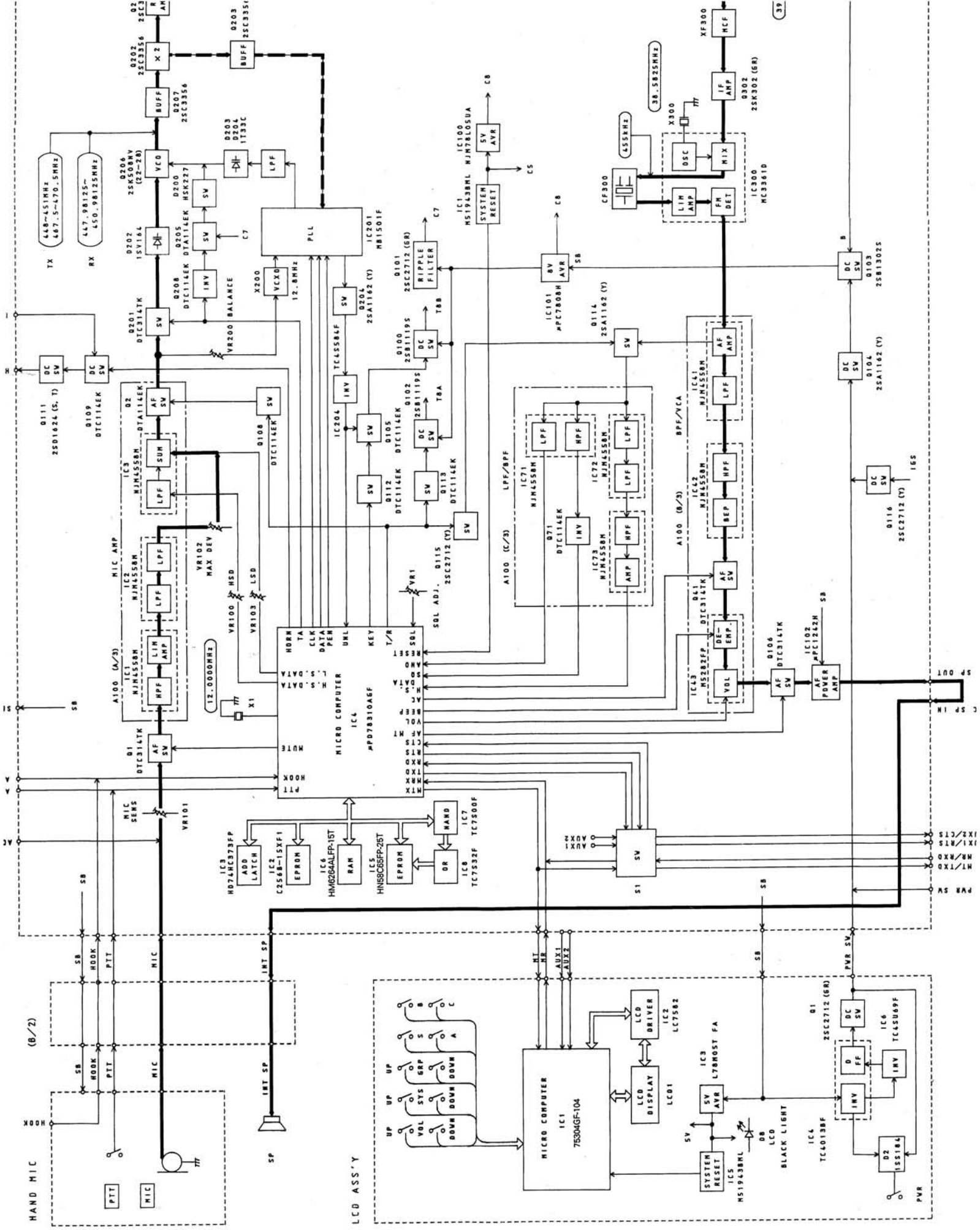
Connector No.	Terminal No.	Terminal Name	Terminal Function
TX-RX UNIT (X57-3930-11/X57-3940-11)			
CN1	1	PS	Power switch control signal input.
	2	SB	Power output after passing through the power switch.
	3	GN	GND.
	4	MT	Serial control signal output to the LCD ass'y.
	5	MR	Serial control signal input from the LCD ass'y.
	6	AUX2	Unused (normally shorted).
	7	AUX1	Unused.
	8	HK	HOOK (microphone hook) signal input.
	9	MC	MIC signal input.
	10	MG	MIC GND.
	11	PT	PTT signal input.
	12	GN	GND.
	13	SB	Power output after passing through the power switch.
	14	SG	GND for speaker.
	15	SO	Speaker output.
CN2	1A	HK	HOOK (microphone hook) signal input.
	2A	MG	MIC GND.
	3A	IG	Ignition sense input.
	4A	PS	Remote power switch control signal input.
	5A	MC	MIC signal input.
	6A	GN	GND.
	7A	SB	Power output after passing through the power switch.
	8A	PT	PTT signal input.
	1B	SI	Input for internal speaker.
	2B	HN	Horn relay drive signal output.
	3B	AUX1	Unused.
	4B	SO	Output for external speaker.
	5B	AUX2	Unused.
	6B	MR	Remote serial control signal input.
7B	MT	Remote serial control signal output.	
8B	NC	No connection.	
CN3	1	SPO	Output for internal speaker.
	2	SPG	GND for internal speaker.
CN4	1	HK	HOOK (microphone hook) signal output.
	2	MC	MIC signal output.
	3	MG	MIC GND.
	4	PT	PTT signal output.
	5	GN	GND.
	6	SB	Power input after passing through the power switch.
	7	SG	GND for speaker.
	8	SO	Input for internal speaker.
J1	1	SB	Power output after passing through the power switch.
	2	PTT-GND	PTT GND.
	3	PTT	PTT signal input.
	4	MIC-GND	MIC GND.
	5	MIC	MIC signal input.
	6	HOOK	HOOK (microphone hook) signal input.

Connector No.	Terminal No.	Terminal Name	Terminal Function
LCD ASS'Y (B38-0332-15)			
CN1	1	POWER SW	Power switch control signal output.
	2	SB	Power input after passing through the power switch.
	3	GND	GND.
	4	MTX	Serial control signal input from TX-RX unit.
	5	MRX	Serial control signal output to TX-RX unit.
	6	AUX2	Unused.
	7	AUX1	Unused.
EXTERNAL CONNECTION			
J2	-	ANT	N-type coaxial connector for antenna connection.
J3	1	+B	13.6V power supply input.
	2	GND	GND.
J4 (Accessory connector)	1	HOOK	HOOK (microphone hook) signal input.
	2	MIC-GND	GND→ON HOOK, OPEN→OFF HOOK
	3	IGS	MIC GND.
	4	POWER SW	Ignition sense input. 3.6V→ON, 0V→OFF
	5	MIC	Remote power switch control signal input. GND→POWER ON, OPEN→POWER OFF
	6	GND	MIC signal input.
	7	SB	Standard modulation with 600Ω, 5mV. GND (for DC and speaker output).
	8	PTT	Power output after passing through the power switch. +13.6V, 1A max.
	9	SP-IN	PTT signal input. GND→TX, OPEN→RX
	10	HORN	Input for internal speaker. Normally connected to No.12 (SP-OUT) with J5.
	11	AUX1	Horn relay drive signal output (open collector). Low level when horn is driven.
	12	SP-OUT	Maximum sink current : 800mA.
	13	AUX2	Reserved for remote operation.
	14	MRX	Output for external speaker. (Normally shorted)
	15	MTX	Reserved for remote operation. Remote serial control signal input. Remote serial control signal output.



TOP VIEW





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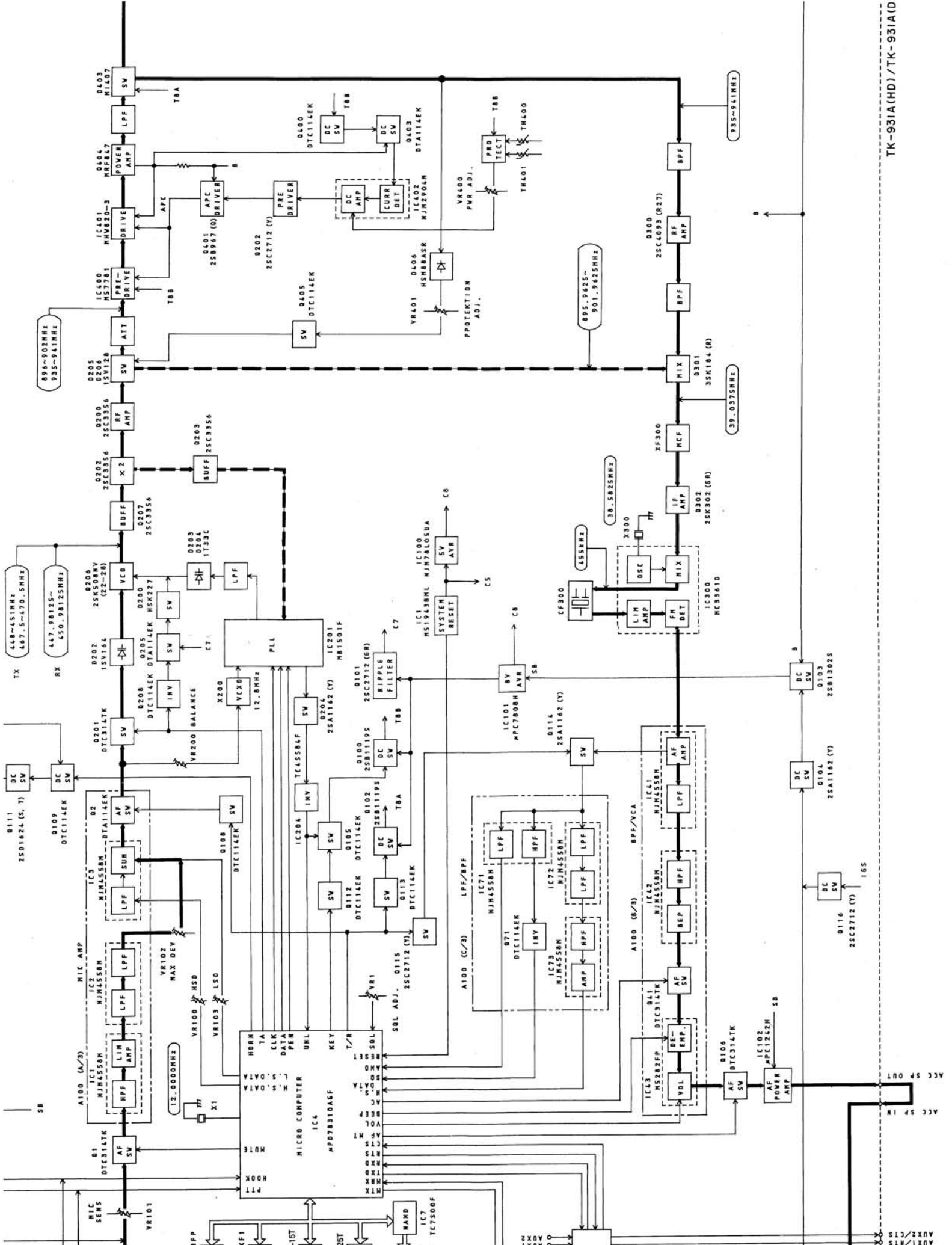
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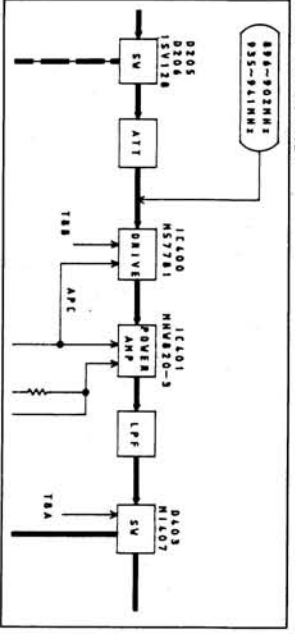
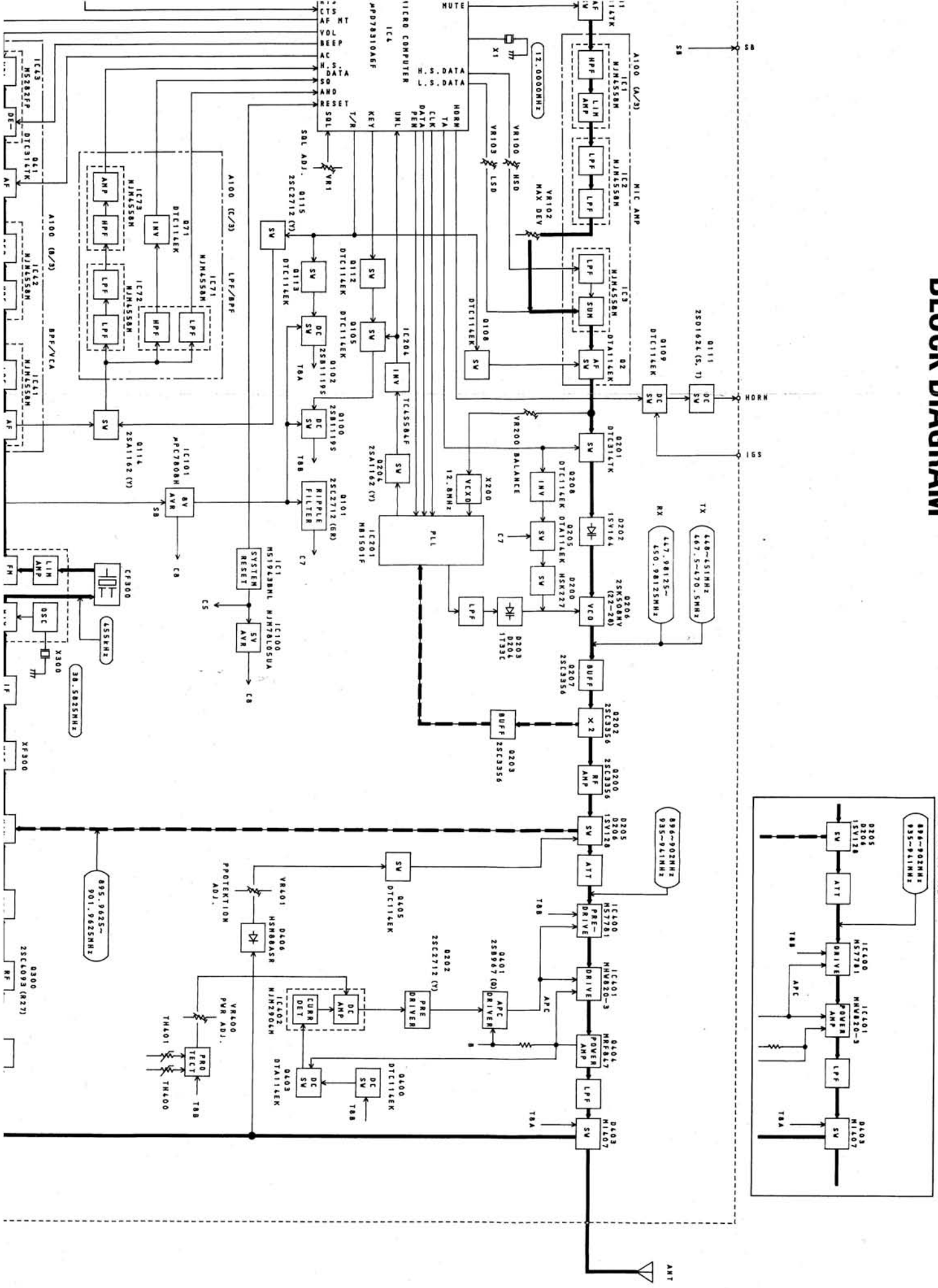
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TK-931A(HD)/TK-931A(D)

K-931A(D)/931A(HD) TK-931A(D)/931A(HD)

BLOCK DIAGRAM



TK-931A(D)/931A(HD) TK-931A(D)/931A(H)

BLOCK DIAGRAM

